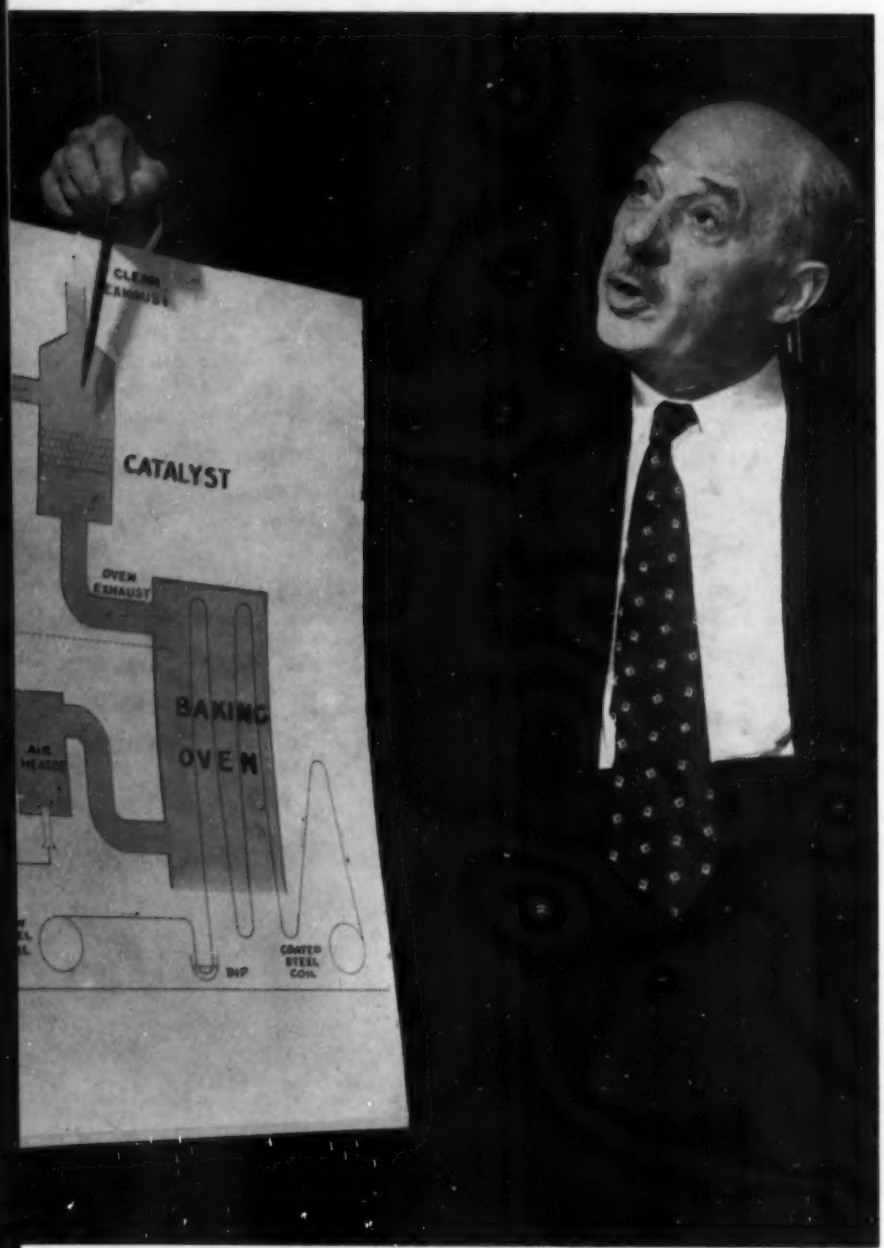
Industry and Power



April 1954

Oxidizing Catalyst
A catalytic method offers the possibility of a solution to many air polution problems 51

Shielding RF Interference
Radio-frequency interference must be reduced to meet new FCC regulations 55

Feedwater Heating
Compilations explaining the effect of full feedwater heating with automatic double extraction turbines 59

Ion Exchanger Runs
New electrical device automatically determines end-point of ion exchanger runs 64

Coal Firing Equipment
The selection and application of stokers and pulverized firing equipment 66

Burning Lignite
Sandow Plant in Texas is burning dried lignite; plans to extract tar and burn char 74

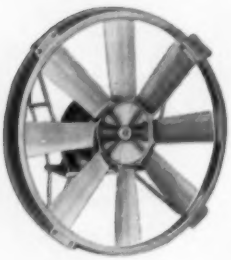
Worm Gearing
A guide to selection and application of various types of worm gearing 79

for engineers and executives responsible for

— engineered plant facilities

What's New IN INDUSTRIAL AIR—MOVING?

NEW EQUIPMENT

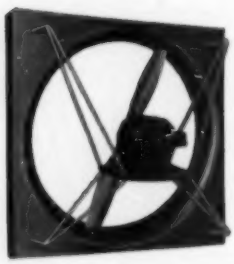


HIGH PRESSURE FAN

All the outstanding features of the standard Hartzell fans, proved in thousands of successful industrial installations, plus a new propeller design which is effective against pressures as high as 4" water gage. 28", 36" and 48".

HIGH TEMPERATURE BLOWER

Now you can move air at temperatures up to 350°, or air containing acids or alkalies, without fear of premature failure of belts and bearings. A powerful blast of air against pressures as high as 7" water gage. 12" to 54".



PANEL FANS

Now you can order the most popular Hartzell fans installed in durable steel panel-type mountings. 24", 28", 32", 36" and 44" fan sizes; single-propeller, two-propeller and multiblade models. Quick and easy to install in any window or wall opening.

HARTZELL

HAS THE ANSWERS

New ideas — new ways to put air to work for industry. In the laboratory and in the field, Hartzell engineers develop a steady stream of them. New equipment to do the job more efficiently. Again it's research plus experience pointing the way to new units which keep the complete Hartzell line ahead of the field, ready with a rugged, reliable fan or blower to meet every industrial air-moving need. And your near-by Hartzell field representative brings the engineering "know-how" of the whole organization right into your plant. Call him the next time you have a tough air-moving problem.

NEW LITERATURE

You'll find a lot of valuable engineering data in these four new bulletins: Bulletin A-108, Fan Engineering Data; Bulletin A-109, Propeller Fans (includes roof ventilators and unit heaters); Bulletin A-110, Vaneaxial Blowers; and Bulletin A-111, Adjustable Pitch Fans. If you don't already have your copies, write for them today.

HARTZELL propeller fan co.

Div. of Castle Hills Corp.

Dept. B

PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

Name _____

Company _____

Street & Number _____

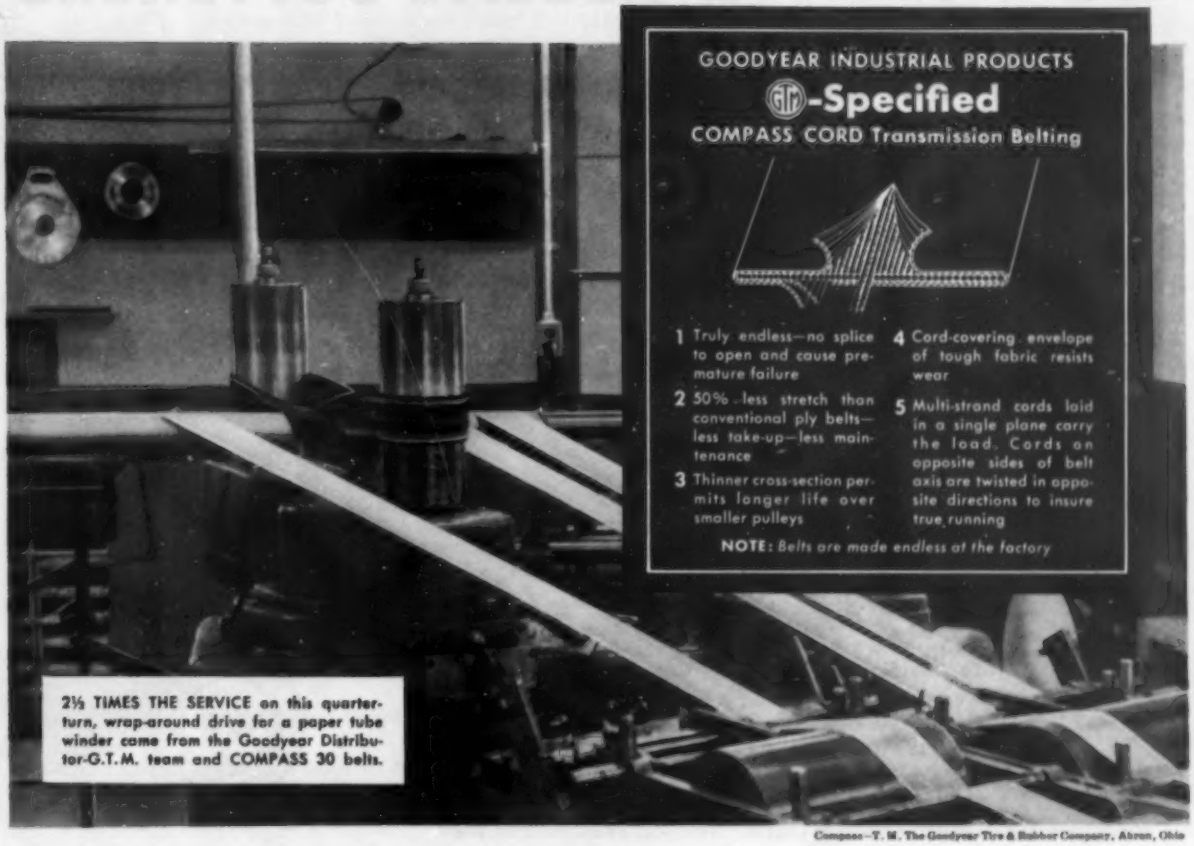
City & State _____

If student, check here for special information ☐

Circle 500 on Reply Card for more data

BEST FLAT BELTS AT EVERY TURN...

come from your Goodyear Distributor


GOODYEAR INDUSTRIAL PRODUCTS
G T M -Specified
COMPASS CORD Transmission Belting
1 Truly endless—no splice to open and cause premature failure
2 50% less stretch than conventional ply belts—less take-up—less maintenance
3 Thinner cross-section permits longer life over smaller pulleys
4 Cord-covering envelope of tough fabric resists wear
5 Multi-strand cords laid in a single plane carry the load. Cords on opposite sides of belt axis are twisted in opposite directions to insure true running
NOTE: Belts are made endless at the factory
2½ TIMES THE SERVICE on this quarter-turn, wrap-around drive for a paper tube winder came from the Goodyear Distributor-G.T.M. team and COMPASS 30 belts.

Compass—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

NOTHING can match a flat transmission belt for flexibility and versatility. In the right hands, it can be a powerful rein on drive costs for any type of equipment. Those hands belong to your Goodyear Distributor. Only he can give you the right belt for only he has the right product, the right knowledge and the G.T.M. —Goodyear Technical Man.

The right product could be any one of the ten different types of Goodyear flat belts. Each is designed to the job. Each is made to the world's highest standard of quality.

The right knowledge and the G.T.M. go hand in hand. Your Distributor is selected for his experience in the field. He is factory trained by Goodyear. And he can always call on the G.T.M. for help on the really tough drive problems.

Added reasons for dealing with your Goodyear Distributor are tailored service, rapid delivery, simplified billing and reduced inventory. All this totals up to longer belt life at lower cost. You can have it by consulting the Yellow Pages of your Telephone Directory or by writing Goodyear, Industrial Products Division, Akron 16, Ohio.

YOUR GOODYEAR DISTRIBUTOR *can quickly supply you with Hose, Flat Belts, V-Belts, Packing or Rolls. Look for him in the Yellow Pages of your Telephone Directory under "Rubber Products" or "Rubber Goods."*

GOODYEAR

THE GREATEST NAME IN RUBBER

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

Circle 501 on Reply Card for more data

HIGH EFFICIENCY

Cochrane ZEOLITE SOFTENERS

provide easy, economical operation

The Cochrane Hydromatic Single Control Valve provides positive, accurate control of all phases of the softening and regenerating cycle.

It is so simple to operate that no technical knowledge of the softening process or the equipment is required. High quality effluent is thus assured at a minimum cost and maximum delivery.

Cochrane's 91 years of water conditioning leadership and its complete line of equipment assures you unbiased recommendations for equipment to performance requirements. For the right answer to your water problem, call a Cochrane Engineer today.

Cochrane
CORPORATION

3172 N. 17th STREET, PHILADELPHIA 32, PA.

In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S.A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris
In Cuba: Lawrence E. Daniel, Inc., Havana
In South America: Servicios Electricos, C.A. (S.E.C.A.) Caracas, Venezuela
In Puerto Rico: F. A. Ortiz & Co., San Juan 5
In Hawaii: Hawaiian Electric Supply Co., Honolulu.

COCHRANE CORPORATION
3172 N. 17th STREET, PHILADELPHIA 32, PA.

Please send me a copy of your Publication 4520-A on your Zeolite Softeners with the Cochrane Hydromatic Single Control Valve.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Hot Process Softeners | Deaerators | Dealkalizers | Demineralizers | Reactors | Continuous Blow-Off | Specialties | C-S Systems

Circle 502 on Reply Card for more data

Industry and Power

Published by Industry and Power Publications

VOLUME 66 — **April 1954** — NUMBER 4

FEATURE ARTICLES

Oxidizing Catalyst 51
Wm. M. Bowen, Chief Engineer, Oxy-Catalyst, Inc.

Eliminating RF-Heating Interference 55
W. C. Rudd, Vice President, New Rochelle Tool Corp.

Automatic Double Extraction Turbines — Effect of Full Feedwater Heating 59
E. V. Pollard, Section Engineer, Turbine Engineering Division, General Electric Company

Electrical Determination of Endpoints for Ion Exchanger Runs 64
Martin E. Gilwood, Director of Research, The Permutit Co.

Coal Burning Equipment . . . Application and Selection 66
Earle C. Miller, Research Engineer, Riley Stoker Corp.

Silo for Handling Sand in Storage 72

Lignite Used as Fuel at New Alcoa Power Plant 74

Protective Boots for Machinery 76

Guide for Selection of Worm Gearing 79
James E. Gutzwiller, Ass't Chief Engineer, Standard Products Div. DeLaval Steam Turbine Company

Centrifugal Pump Controls 83
Igor J. Karassik and Roy Carter, Worthington Corporation

Cover Photo — Eugene J. Houdry, Oxycat Inventor
See Cover story page 86

DEPARTMENTS

Acorns	6	Readers' Guide	99
New Equipment	8	Classified Advertising	112
New Bulletins	35	Available Reprints	112
Spot News	86	Meetings	113
Names Make News	94	Advertisers' Index	114

Established May 1920

Hunter Hughes *Editorial Director*

Associate Editors
A. M. Steinmetz F. D. Hirschfeld
H. A. Bergen J. E. Hinkley

Department Editor
J. C. Dean

Editorial Assistants
R. K. Becker D. A. Damaske
Dorothy Wolf

Jack Knuth *Art Director*
L. R. Sentowski *Art Editor*

F. C. Donohue *Production Mgr.*
John B. Klein *Circulation Mgr.*

E. R. Gauley *Publisher*

Sales Representatives

NEW YORK, T. E. Gordon
11 West 42nd St.,
OXford 5-1495

PHILADELPHIA, D. L. McKechnie
816 Lancaster Ave., Villanova, Pa.
Bryn Mawr 5-4692

CLEVELAND, O. D. Young
3304 Avalon Rd., Shaker Heights
WYoming 1-4841

CHICAGO, J. D. Murray
360 N. Michigan Ave., Room 614
DEarborn 2-3519

LOS ANGELES, Justin Hannon
4068 Crenshaw Boulevard
AXminister 2-9501

BPA NBP INDUSTRY AND POWER including INDUSTRIAL POWER, is published monthly by Maujer Publishing Company, 520 Main Street, St. Joseph, Mich. Member of Controlled Circulation Audit and National Business Publications, Inc. Acceptance under Section 34.64 P.L.&R. authorized by U. S. Post Office. Form 3547 requested. Copyright 1954, Maujer Publishing Company.

Subscription information: Mailed without charge to executives and engineers, in selected plants and organizations, who are responsible for the selection, installation, operation and maintenance of equipment required for Engineered Plant Facilities. To all others there is a subscription price of $10.00 per year in U. S. Outside U. S. subscription price $15.00. Single copy $1.00.

RUGGED, RELIABLE
VARIABLE-SPEED CONTROL

CONSIDER THE IMPORTANCE OF LEWELLEN LEVER & LINK SUSPENSION. This distinctive feature distributes equally the thrust bearing load on every ball in the bearing, at all speeds and positions, and while changing speeds. Thrust bearings are mounted at outer end of disc hub. When lever moves, discs move positively; belt is not required to force discs apart. Here's smooth operation!

THEN, NOTE PARTICULARLY — the Lewellen DOUBLE-BLOCK, UNI-TIP BELT keeps tension at a minimum on belt, bearings, and shafts. UNBREAKABLE BELT SPLICE — an outstanding feature for uninterrupted operation. SIMPLE, POSITIVE LUBRICATION SYSTEM for disc hubs, keys, and shaft.

if it's variable-speed control . . . look to

LEWELLEN

TRANSMISSIONS • MOTOR PULLEYS

Open or enclosed, vertical or horizontal Variable-Speed Transmissions in all sizes from fractional h.p. to 60 h.p. . . . Variable-Speed Motor Pulleys in all ratings from fractional to 7½ h.p. Speed range, 3 to 1 for all pulley sizes. (One size—2¾ to 1.)

Service in variable-speed control exclusively for more than 50 years. May we help you?

LEWELLEN MANUFACTURING CO.
COLUMBUS, INDIANA
Circle 503 on Reply Card for more data

acorns

. . . recently announced . . . worth watching

Lighting Maintenance

● G-E lighting experts have found that while new lamps are not expensive; replacing them can be. For example, it takes about 33 hours of a maintenance man's time to replace 100 burnouts one at a time. Depending on labor costs, the lamp change may be more expensive than the lamp itself.

The experts recommend that lamps be replaced in groups, saving the brightest, cleanest 20 percent of the replaced lamps for spares. Burnouts are replaced with these spares. When the spares are gone, it's time for group relamping again.

Lightweight Building Block

● Lightweight all-ceramic building block, possessing many advantages over common cement block, may prove to be economical domestic construction material. It was originally developed by the Armour Research Foundation for Arabian-American Oil Co. to provide low-cost housing in Saudi Arabia.

Disposing Starch Wastes

● Various methods of disposing of non-soluble organic matter in potato starch factory wastes have been tested by the U. S. Dept. of Agriculture. It was found that microbiological treatment of the waste is a relatively inexpensive way of reducing the solubles to a level that will not cause stream pollution.

Lower Titanium Prices

● If a new process of electrically separating titanium from its ore proves commercially feasible, it could bring the price of the metal into a range more competitive with that of presently used materials in applications where titanium's properties warrant its consideration.

New Welding Standards

● Since the commercial introduction (October 1953) of electrodes with powdered metal in their coatings, manual welding speeds have been increased on the order of 50 percent, and there is a smoothness in appearance and freedom from spatter almost equal to that obtained with automatic welding. According to the Lincoln Electric Co., cost and performance data indicate that welding procedures will shortly be completely revised to new standards because powdered iron electrodes will tend to make obsolete existing electrodes.

Synthetic Fuels

● According to a survey by the Corps of Engineers, there are more than 200 geographic areas within our national borders apparently suited to the production of liquid fuels from coal or lignite. They have a capacity of 15 million barrels a day. Added to this are areas in Colorado and Utah which can provide another 7 million barrels a day from oil shale.

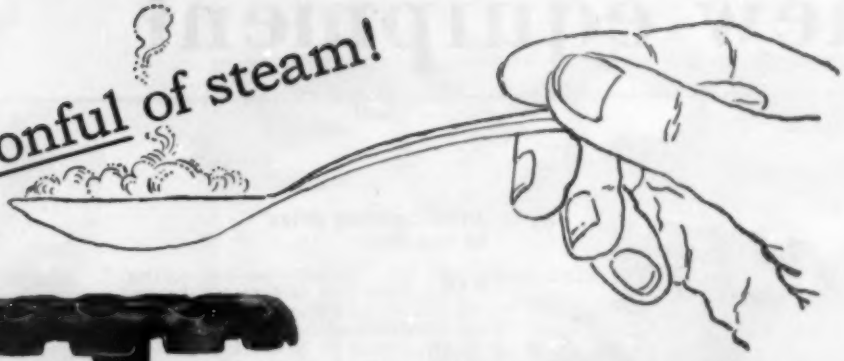
Moving Sidewalks

● The principles of conveyorization have now been successfully designed and proven for passenger applications by the Goodyear Tire & Rubber Co. and Stephens-Adamson Mfg. Co. Their moving belt sidewalk (trade mark "Speedwalk") has found its first industrial commercial application in the Goodyear Aircraft Co. plant. Upon completion, it will facilitate the movement of employees in the plant.

Looking Ahead

Next month the readers of INDUSTRY AND POWER will be served a very special bill of fare. For the past six months the editors have been traveling around the country working with users and manufacturers of unit steam generators—generally known as "Package Boilers." A big 24-page section in color has been compiled under the direction of Associate Editor Arthur Steinmetz that will bring our readers up-to-date on the design, installation, and operation of packaged and semi-packaged units. It will be an issue that anyone dealing with industrial steam generation will not only read but will file as the most important reference information now available.

a teaspoonful of steam!



HERE'S THE ANSWER
TO YOUR SMALL FLOW
CONTROL PROBLEMS

a NEW LESLIE REDUCING VALVE

for accurate, foolproof regulation of small flows of steam, air, gas or liquids, with inlet pressures to 1000 psi and reduced pressures from 2 to 400 psi.

Change operating conditions quickly and easily with simple, handwheel adjustment —no need to waste time changing springs or swapping parts. Check these widely accepted Leslie features that are standard in the new, efficient, Leslie Small Flow Reducing Valve.

Check these features

- ✓ Simple, compact construction
- ✓ Top quality materials
- ✓ Metal Diaphragm
- ✓ Entirely enclosed—no stuffing boxes
- ✓ Corrosion resistant springs
- ✓ Hardened stainless steel valve
- ✓ Interchangeable inner valves

SEND FOR DESCRIPTIVE BULLETIN 511-A WITH *COMPLETE* CAPACITY TABLES

Before you order—

The new Class LCB is just one of the many units that are *special* with most manufacturers but are *standard* with Leslie.

Check to see if any pressure, temperature or level control you want is standard with Leslie, before you order. Play it safe. Your Leslie Engineer is listed under "Valves" or "Regulators" in the classified telephone directory in principal cities.

TRADE LESLIE MARK

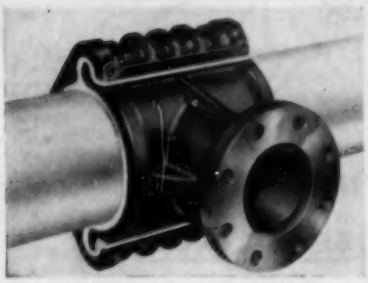
THE FIRST NAME IN PRESSURE, TEMPERATURE AND LEVEL CONTROLS
Since 1900

LESLIE CO., 263 Grant Avenue, Lyndhurst, New Jersey

Circle 504 on Reply Card for more data

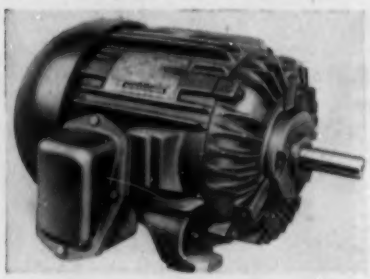
new equipment

. . . new developments



Boltless tapping sleeve is for cement-asbestos pipe

D10 Designed to eliminate the parts generally affected by corrosion and constructed of high quality grey cast-iron, a boltless tapping sleeve for cement-asbestos pipe has been developed by The Corey Manufacturing Co. Elimination of the usual caulking process and the simplicity of installation makes it possible for unskilled workmen to make a new installation or a tapping sleeve replacement in a few minutes. Water-tested in excess of 1700 lb psi, it offers complete leakproof performance. Sleeves are furnished in a wide range of tapped and flanged outlets for use in water and gas service.

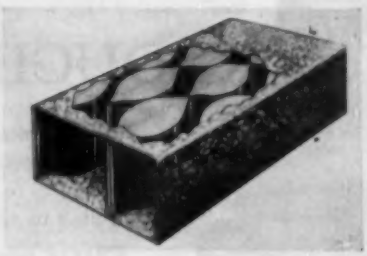


Complete line of motors will be fan-cooled

D11 A-c squirrel cage induction motors in frame sizes 326 and smaller conforming to revised NEMA standards are announced by Allis-Chalmers Manufacturing Co. With equal horsepower in a smaller package, the new Type G motors will retain all important features of the company's "AP" line plus certain improvements such as greater protection and fan cooling for all sizes. Now available in frame sizes 182 and 184, larger frame sizes will be made available at five-month intervals.

Lead coating dries in one hour

D12 Rust preventative lead coating Blakled is said to be the answer to the corrosion problem of rusting of steel. Distributed by U. S. Steel Supply Div. of U. S. Steel Corp., it is neither a conventional paint skin nor a pigment ground into a vehicle. It "fills in" the surface of steel and actually replaces moisture and air on a steel surface, thus eliminating the principal cause of rust. Blakled may be applied to wet, brushed rusted surfaces, dry, or light mill scaled steel. It dries in an hour, may be dipped, sprayed, or brushed.

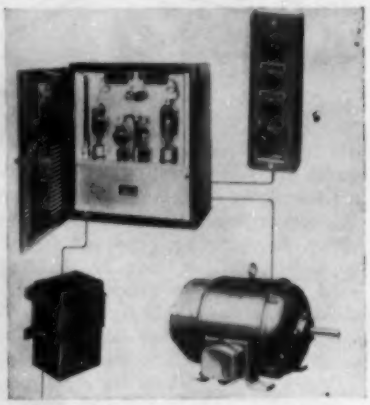


Units reduce high and low frequency noise

D13 The Aircoustat, a device for reducing fan and air noise in air conditioning systems, can be installed directly into the duct work by means of flexible connections. Introduced by Industrial Sound Control, Inc., the units also silence low frequency noise. One standard seven ft unit is said to reduce noise level more efficiently than 100 ft of duct lining. It is available in eleven standard sizes for use with different styles and sizes of ducts, and in three types to meet any conditions.

Addition of polar compound improves cutting oil

D14 The improved series of Sunicut "W" Cutting Oils contain Sun Oil Company's all-petroleum, polar compound PETROFAC. This compound is said to give cutting oils metal-wetting and oiliness properties similar to those obtained with animal and vegetable oils. It cannot turn rancid or support the growth of bacteria that cause skin irritations. Technical literature is available.



Adjustable-speed drive operates from a-c lines

D15 Stepless adjustable-speed drive, the Electronic Select-A-Spede, announced by The Louis Allis Co., is designed for operation from a-c power lines and is available with d-c drive motors in standard NEMA frame sizes, ¼ to 15 hp. With speed ranges of 5:1, 20:1, or 50:1, with 100:1 available for some applications, speed regulation is said to be especially precise. When the unit is used with optional tachometer feedback equipment the regulation will be ± ½ percent. A variety of optional control features is also available. The complete unit consists of an anode transformer, electronic control panel, pushbutton station, and a specially designed adjustable-speed d-c drive motor.

Speed control power ratings are extended

D16 Power ratings for General Radio Company's Variac motor speed controls now extend from 1/15 to 1½ hp. New models include Type 1703-A 1/6 hp control, Type

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card, pages 34/35 & 98/99.

BETZ. *A Great Name In Water Conditioning*

...meet "Mr. Outside"

■ Unusual title for a professional engineer? Perhaps so. Here's what we mean.

Actually, our activities are by no means limited to the regular chemical conditioning and control of boiler and cooling water. Take the Betz Consulting Division, for example.

Here is an entirely separate unit, staffed with chemical, mechanical and sanitary engineers, qualified through years of experience to make unbiased recommendations for the solution of problems involving the *external* conditioning of industrial and municipal water supplies . . . and for treatment and disposal of industrial wastes.

Many, if not most water or waste treatment problems are individual in character. They require study by *specialists* in order to reach a solution that is both operationally and economically sound. Such studies made by the staff of the Betz Consulting Division have saved much effort and productive time for hundreds of plants across industry. How can this important Division of Betz *completely-integrated* water conditioning service assist you?

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa.

In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

Circle 505 on Reply Card for more data

WATER FOR PROCESSING FIBER GLASS is brought from deep wells by these six Worthington vertical turbine pumps at the Libbey-Owens-Ford factory in Parkersburg, W. Va. Any type of drive can be used with the pumps.

Daily, these pumps help produce enough glass filament to circle the globe 1700 times!

Libbey-Owens-Ford uses Worthington vertical turbine pumps in manufacture of fiber glass

In Parkersburg, West Virginia, the new Fiber-Glass Division of Libbey-Owens-Ford spins over 42 million miles of fiber glass filament every day.

All the water used for cooling and making process steam in this vast operation is supplied by six Worthington vertical turbine pumps. The pumps, with a capacity of over 6,000 gallons per minute, are used on cooling tower service.

Like other leading names in industry, Libbey-Owens-Ford has found that Worthington vertical turbine pumps can provide the most economical solution to many plant pumping needs. Refineries, chemical plants, pharmaceutical plants, manufacturing plants—all are turning to these modern pumps as a really dependable means of delivering water.

If you are faced with the problem of pumping hot water or volatile liquids, write for Bulletin W-450-B39 to Worthington Corporation, Vertical Turbine Pump Division, Harrison, N. J., and find out about the Worthington vertical turbine pumps for yourself. D.3.15

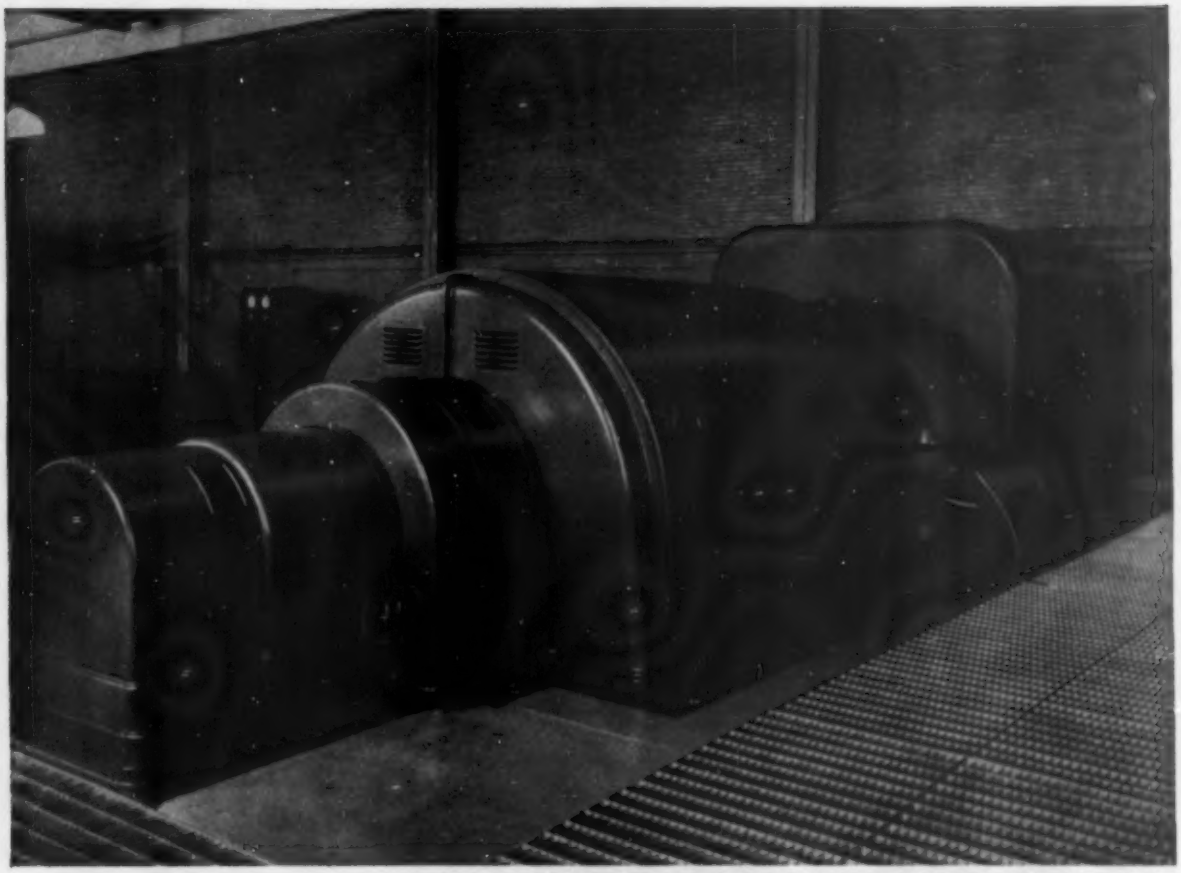
WORTHINGTON

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB

CENTRIFUGAL • ROTARY • STEAM • POWER • VERTICAL TURBINE

CONSERVE GROUND WATER—IT IS A VALUABLE RESOURCE

Circle 506 on Reply Card for more data



SECOND WORTHINGTON TURBINE GENERATOR installed at the Kohler Co. in Kohler, Wisconsin. Steam is extracted from this 6000-kw unit at the rate of 120,000 lb/hr. at 225 psi and 80,000 lb/hr. at 5 psi.

KOHLER OF KOHLER selects Worthington again

In 1949, Kohler of Kohler, manufacturers of plumbing fixtures, heating equipment, electric plants, air cooled engines and precision controls, installed their first Worthington turbine generator.

The 3000-kw Worthington unit operated in parallel with the outside power supply and delivered the rated kw load while automatically extracting 120,000 lbs. of steam per hour at 225 psi for heating and process work.

Because of the extremely economical and dependable operation of this machine, another Worthington turbine generator was the logical choice when power requirements increased. In November of 1952, a 6000-kw Worthington turbine generator was installed.

Now the two Worthington units furnish process steam for the plant and also supply a large part of their electrical requirements.

Follow the lead of Kohler and find out how Worthington turbine generators can pay off for you, too. Write to Worthington Corporation, Steam Turbine Division, Section T.4.5, Wellsville, New York.

T.4.5

WORTHINGTON

STEAM TURBINES

Single- and Multi-Stage Turbines • Turbine-Generators • Deaerators • Boiler Feed Pumps • Surface Condensers

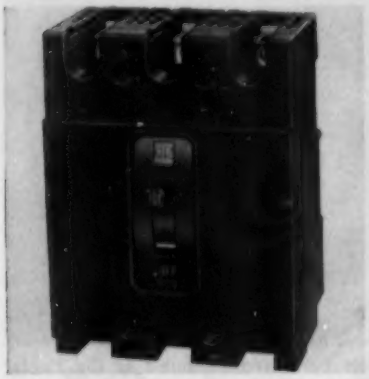
A GREAT TEAM IN STEAM

Circle 507 on Reply Card for more data

new equipment

—Starts on page 8

1704-A 1 hp control, Type 1705-A 1½ hp control, Type 1701-AM 1/15 hp control with single speed range, and Type 1702-M ¾ hp control with remote station push-button and speed control. These models use the same basic system of control as the earlier units, and make possible the complete elimination of electron tubes or rotating machinery in operating d-c motors from a-c lines. Reversing of the motor is obtainable in all models and dynamic braking is provided in all but the smallest size.



Circuit breaker handles up to 100 amp capacity

D17 The "E" frame 100-amp circuit breaker can be used in panelboards, switchboards, load centers, and all types of individual enclosures. Because of compact, over-all design (conventional "E" frame size) and mounting arrangement, the breaker saves installation time and space according to the manufacturer, I-T-E Circuit Breaker Co. It is available in ratings from 15 to 100 amp: 1 pole, 125 v a-c, d-c; 2 and 3 pole, 250 v a-c, 125/250 v d-c; 5000 amp interrupting.

Conductivity cells detect boiler contaminants

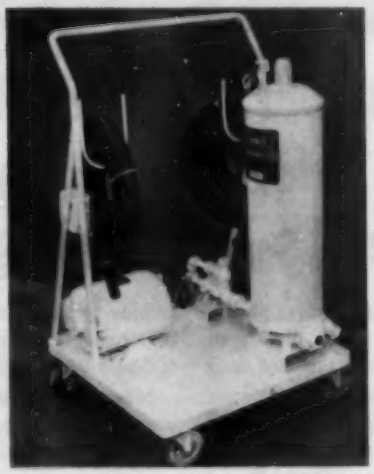
D18 Electrolytic conductivity cells for power plant applications developed by The Foxboro Co. are designed for use with Dynalog Conductivity Instruments. The cells detect the concentration of solids dissolved in boiler feed water, steam sample, and condensate return to a boiler. The cells, having constants of 1, .1, and .01, are available in two types, both designed for insertion in a pipeline or a tank. One type includes a valve and fittings to provide for removal of the cell under pressure.

Weatherproof wire has outer braid of glass yarn

D19 Triple knit weatherproof wire, with an outer braid of Fiberglas yarn, developed by Rome Cable Corp. is available in sizes 14 through 4 Awg. The glass braid is resistant to moisture, heat, chemical action, and abrasion. Tests are said to have shown that this wire picks up as much as 50 percent less moisture than cotton-knit wire of the same type and has a tensile strength several times higher than comparable organic fibers.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.

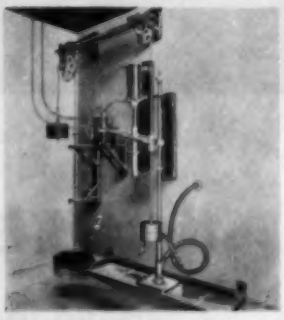


Portable unit filters particles to 25 microns

D20 A portable filter completely equipped with pump, motor, oil resistant hose, gages, and filter is announced by Cuno Engineering Corp. Known as the Cuno Portable, it filters such fluids as lube and hydraulic oils, coolants, and a wide range of heavy and thin industrial fluids. The standard design is equipped with a ½ hp motor and a gear pump with a capacity of 4 gpm. The filter removes all particles down to 25 microns in size. Other features for special designs are centrifugal pumps, higher capacities, and degrees of filtration of 10 and 50 microns.

Instrument valve for high-pressure service

D21 Specially designed and engineered for such services as instrument panels and lines, gage, bypass and corrosive lines, and orifice meters, the new 6000 psi Hancock Stainless Steel Instrument Valve is small (see illustration), easy to handle, weighs only 2¼ lb. Developed by Manning, Maxwell & Moore, Inc., its space-saving compactness permits close alignment of piping with near structures. The packing gland can be readily pulled tight in close quarters and disassembly presents no problem. Stainless steel assures maximum protection against corrosion. Sizes available are ¼, ⅜, and ½ in.

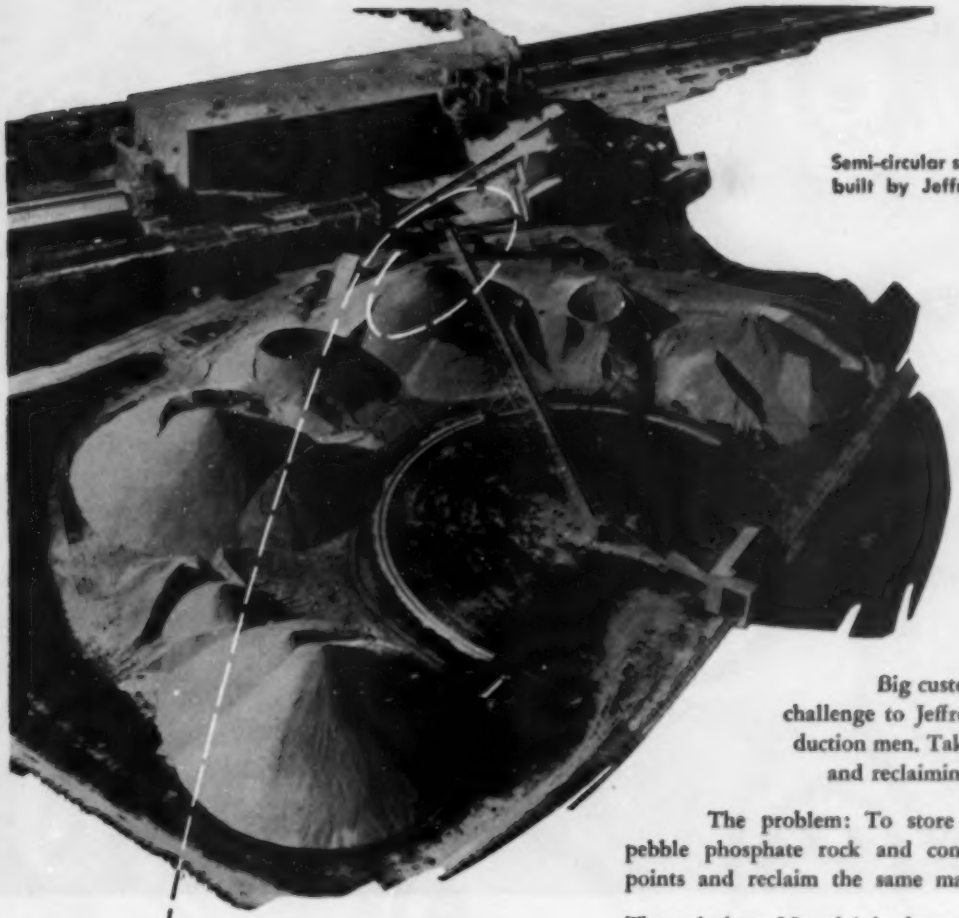


Unit automatically skims oil from surface of liquid

D22 Known as the Oil Skimmer, a device developed by Simplex Valve and Meter Co. automatically and continuously skims oil from liquid surfaces in collection tanks or chambers. The unit is said to provide a means of preventing oily discharge into rivers and streams. All operating parts are of stainless steel or bronze. A suction pump sucks up the reclaimed oil through flexible hose and delivers the oil to a reclaiming tank.

Pressure joint features special assembly plate

D23 Johnson Corporation's redesigned Type J Rotary Pressure Joint is available with a special assembly plate which serves to hold the internal parts of the joint in position when the head is removed. The syphon pipe can be removed without disturbing the joint proper or the steam inlet connection. All Type J Joints, one inch and larger, are designed so that



Semi-circular storage piles built by Jeffrey Stacker.

from top to bottom ... it's JEFFREY

Big custom jobs are a constant challenge to Jeffrey engineers and production men. Take this modern storage and reclaiming system for instance:

The problem: To store 1" dia. and smaller pebble phosphate rock and concentrates at different points and reclaim the same material for processing.

The solution: Material is dumped from railroad cars into track hoppers over two Jeffrey-Traylor feeders . . . moves on Jeffrey Belt Conveyor — at 800 T.P.H. — to track-mounted Jeffrey Stacker which turns on a 270′ radius to build 80-foot-high semi-circular piles of approximately 320,000-ton capacity. A series of valves beneath the piles discharge onto a traveling hopper which feeds two Reclaiming Belts at 336 T.P.H. each for processing. Rock can be removed at controlled rate from any point in pile or several points at once.

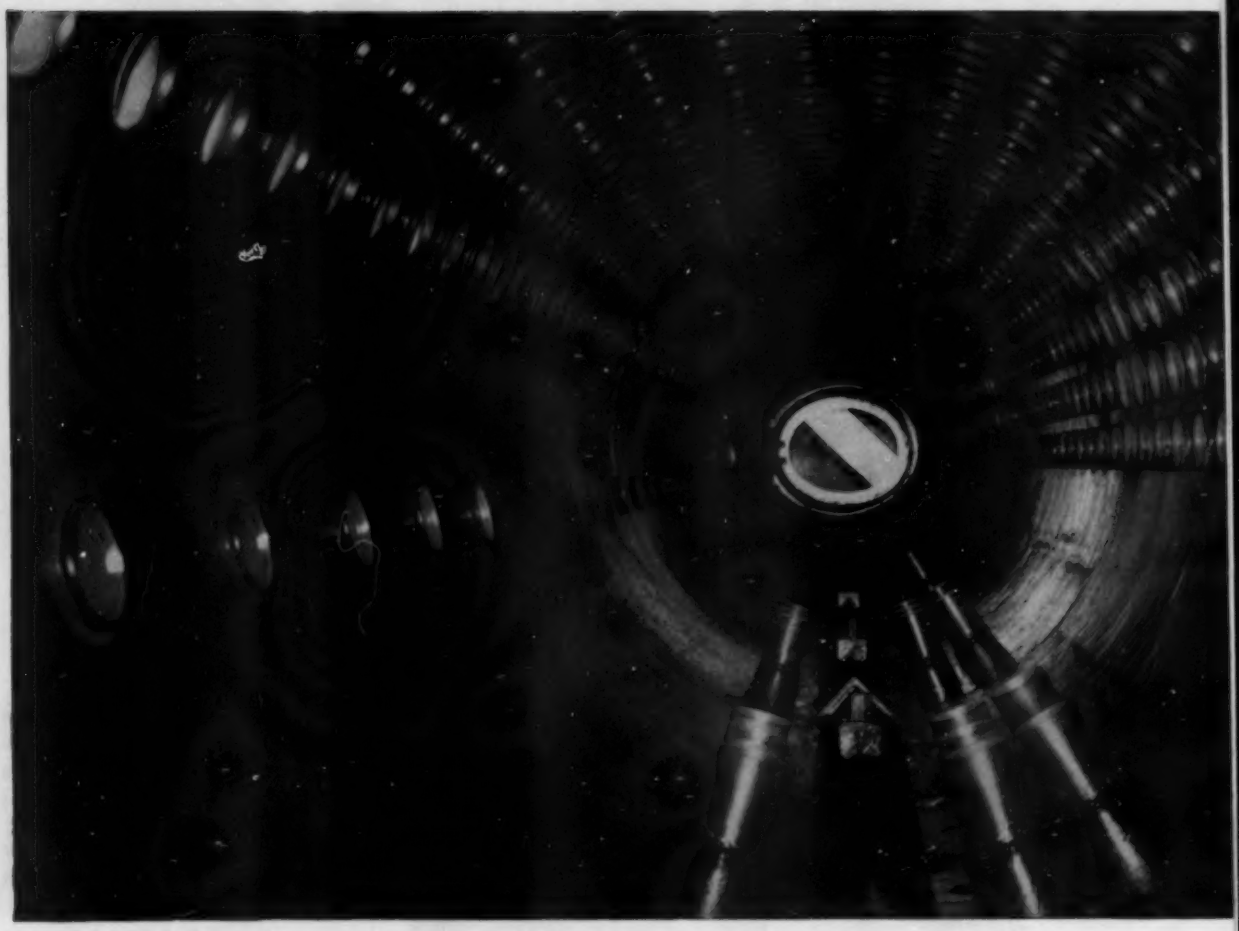
The entire installation is built to withstand hurricane winds . . . to operate efficiently at low cost . . . to meet the rigid engineering standards of Jeffrey and its client. Write for Catalog 852.

Jeffrey Belt Conveyors in tunnels under piles reclaim materials to process.

THE JEFFREY MANUFACTURING CO.
Columbus 16, Ohio
sales offices and distributors in principal cities
PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED
. . .IT'S A JOB FOR JEFFREY!

Circle 508 on Reply Card for more data



Clean as a whistle
AFTER ONE YEAR OF DEARBORN 659

This boiler used to be cleaned once a year... an expensive, time-consuming job. That was before a Dearborn engineer recommended using 659* sludge conditioner. The picture shows the results. The boiler, upon inspection after a year of this treatment, is clean as a whistle... yearly cleaning has been eliminated.

Dearborn's formula 659 conditions sludge to fluid form, preventing adherence to internal surfaces. Treated sludge is then readily removed by blowdown. In addition, Formula 659 contains Dearborn's patented polyamide anti-foam agents for improving steam quality. Result: higher steam purity, prevention of corrosion in feed lines, closed heaters, economizers and boilers.

BULLETIN NO. 5008 GIVES THE COMPLETE STORY

DON'T OVERLOOK RETURN LINES. Filmeen** prevents return line corrosion, reduces shutdown time and loss of valuable condensate. Safe to use where steam directly contacts food or is used in sterilization. *ASK FOR BULLETIN NO. 5013-A*

*Pat. No. Re-23085

**Pat. No. Re-23614

Dearborn
TRADE MARK

COMBATTING CORROSION EVERYWHERE SINCE 1887

DEARBORN CHEMICAL COMPANY · Merchandise Mart Plaza, Chicago 54, Illinois

Dearborn

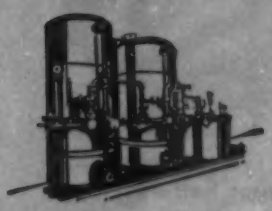
SINGLE WATER TREATMENT SOURCE FOR THOSE WHO TAKE PRIDE IN THEIR PLANT OPERATION

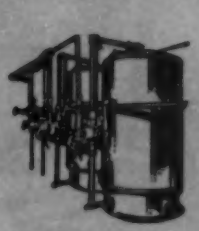
Dearborn provides complete water conditioning and engineering service in one customized program tailored to meet your exact requirements. Dearborn service gives you:

1. Initial plant survey.
2. Recommendations for internal and external treatment.
3. Feeding and proportioning equipment.
4. Water analysis and supervisory service.

Whether your program calls for a system that is manual, semi-automatic or automatic, Dearborn has all the facilities to maintain top boiler efficiency with economical operation. Look to Dearborn ...the *single source* for your water conditioning program.

DEARBORN EXTERNAL TREATMENT SYSTEMS





Dearborn has the knowledge and experience to design and furnish complete ion-exchange equipment, including mono-bed or 2-bed demineralizers, sodium hydrogen split stream units, sodium exchange softeners, designed for use either alone or in conjunction with hot lime softeners.

INTERNAL TREATMENT EQUIPMENT

Get plus results with Dearborn engineered feeding, proportioning and test equipment. Let your Dearborn engineer analyze existing equipment, plan a plant layout, and recommend a system designed to fill your needs—either manual or automatic.

ASK FOR BULLETIN NO. 5000.

KNOW YOUR DEARBORN ENGINEER

Dearborn has specialized in the conditioning of water and the control of corrosion since 1887. This broad experience in water treatment and rust prevention—plus Dearborn's extensive research and laboratory facilities—is at your service. It will pay you to consult your Dearborn engineer.

ASK ABOUT DEARBORN'S SERVICE AGREEMENT

When your Dearborn engineer calls, ask him to explain the advantages of: a) scheduled on-the-spot tests, b) consultation with plant operation personnel, c) special laboratory tests and reports, d) newest water conditioning methods.

Circle 509 on Reply Card for more data

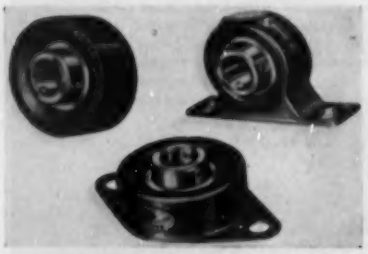
new equipment

—Starts on page 8

assembly plates can be added at any time. Two straight pipes may be threaded to the hinged syphon elbow, eliminating the need for a curved pipe serving as a mechanical syphon pipe. As the first pipe is inserted in the roll or drum, its weight closes the elbow, which enables the stainless steel seat to create a closed line that is both leak proof and pressure proof.

Welding range is 70 to 500 amp

D24 G-E Type WR40A welder, 400-amp, three-phase, d-c, rectifier-type announced by General Electric Company's Welding Dept. can be equipped to operate on two-phase power. With a current welding range of 70 to 500 amp, it is operable on 220/440 v reconnectable to either voltage. Class H (silicone) insulation gives extra protection against high temperatures and is moisture, fume, and chemical resistant.



Rubber mounted bearings reduce noise and vibration

D25 Sealmaster rubber mounted ball bearing units are now available in rubber mountings with pressed steel housings in six shaft sizes ranging from ½ to 1 in. as pillow blocks, flange units, and cartridge units. Designed by Stephens-Adamson Mfg. Co. for reduction of noise and vibration, they are particularly adaptable for use on air conditioning equipment and other light duty applications. The synthetic rubber mounting rings are oil and grease resistant and the bearings are lubricated for life at the factory. Housings are designed for maximum rigidity and can be easily mounted with only two bolts. A bulletin is available.

Exhaust silencers eliminate high and low frequency noise

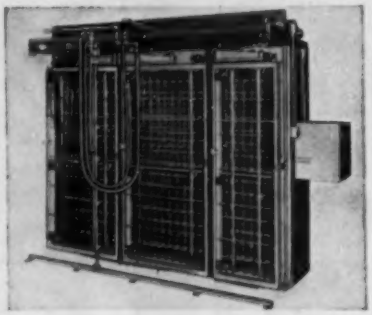
D26 A line of high velocity steam and air exhaust silencers, designed to set new standards in noise control in critical and non-critical areas, has been developed by the Burgess-Manning Co. Known as series "ADS" Acoustic Discharge Silencers, they are designed to eliminate high and low frequency noises caused by high velocity discharge from steam and air devices. They will be available in three models: ADSO for optimum silencing in critical areas; ADSS for the type of silencing required in semi-residential and light industrial areas; and ADSC for commercial silencing in non-critical areas. All models will be available in standard 8 to 30 in. pipe size, but special sizes are available upon request. A bulletin is available.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.

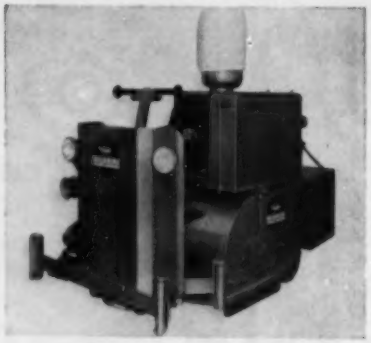
Limit switch acts as an automatic control

D27 Designed for use where movement can be expressed as shaft revolutions, the Rotary Limit Switch developed by Gemco Electric is primarily for reversing movement between two limits such as the opening and closing of electrically operated doors, large valves, and machinery. It works as an automatic control. The enclosure is of Gemco Fibraloy, a fiber-glass alloy that is resistant to shocks, acid solutions, alcohols, hydrocarbons, and heat. NEMA type 4 and 7 enclosures are also available. Two cam operated micro switches supply one open and one closed circuit for each travel position.



Washer operated automatically

D28 American Air Filter Co. has redesigned the Electro-CELL electronic precipitator to provide semi-automatic reconditioning of the collector plates. The recently developed Type H Washer washes the collector plates with water sprays and recoats them with a dust holding adhesive. The entire operation is automatic after a starting button is pushed. This washer is optional equipment available for all sizes larger than 6 ft high by 6 ft wide.

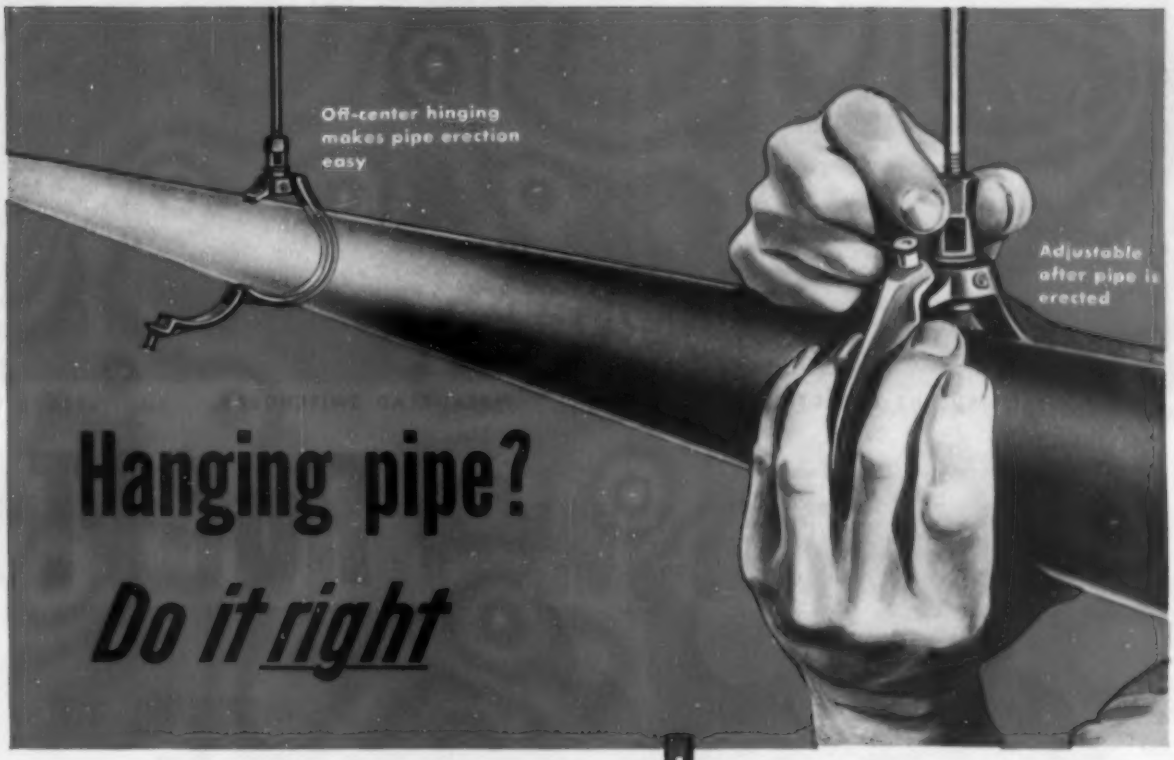


Sweeper uses battery power

D29 Using two electric motors, the Electrisweeper saves 25 percent on power costs according to the manufacturer, Wilshire Power Sweeper Co. It is practically noiseless in operation and, because it uses electric storage battery power, it can be used in places where carbon monoxide fumes and noise are objectionable. It may also be used in areas with exceptionally high fire and explosion hazards. It will sweep in excess of 40,000 sq ft per hr.

System is designed for minimum 'down time'

D30 In the three-part pneumatically-operated instrument system known as the Metagraphic System announced by The Bristol Co., each of the basic units is packaged separately. Units are: a transmitter, a receiver



Hanging pipe?

Do it right

There's a stock Grinnell hanger for every piping requirement

SAVE MONEY ON ASSEMBLY. Cut installation time, get better, stronger installations, with Grinnell adjustable pipe hangers and supports.

NO SAG . . . NO WATER TRAP. Grinnell hangers permit adjustment after pipe is installed. This makes it possible to prevent sagging pipe and water traps, and assures positive drainage for the entire system.

FOR EVERY INSTALLATION. There is a stock Grinnell hanger for every need from simple water pipe to high pressure, high temperature steam line. Where necessary, there is a hanger to compensate for thermal movement.

PLAY SAFE. Don't waste time or take chances on inadequate pipe hangers and supports. All Grinnell hangers comply with rigid piping code requirements.

Enlarged section showing locking feature

GRINNELL ADJUSTABLE SWIVEL PIPE RING
(Split Ring Type)

- Hinging of ring is off-center. This provides sufficient seating to hold pipe before closing ring. Wedge-type pin is loosely but inseparably cast into the hinged section for fastening after pipe is in place.
- To obtain proper adjustment, swivel shank can be turned easily by hand when the weight of the pipe is temporarily taken off the ring.
- When weight is returned, patented swivel shank locks automatically, preventing change of adjustment due to vibration. Wire retaining ring keeps swivel shank and pipe ring or yoke from separating, makes assembly a single unit.
- 12 sizes have load range of 80 lbs. for ¾" size to 1510 lbs. for 8" size. May be used in connection with practically any building attachment.

GRINNELL

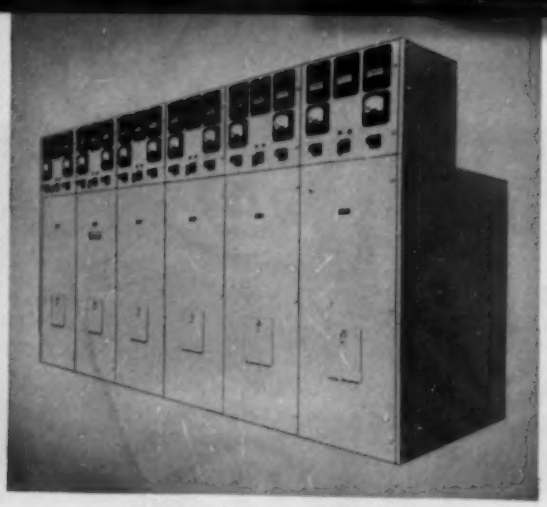
AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

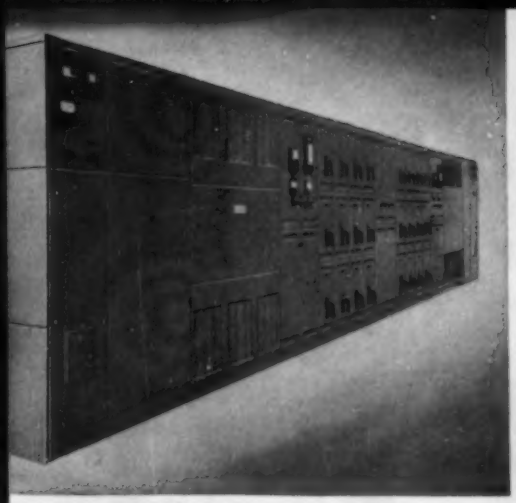
Circle 510 on Reply Card for more data

METAL-ENCLOSED BUS STRUCTURES



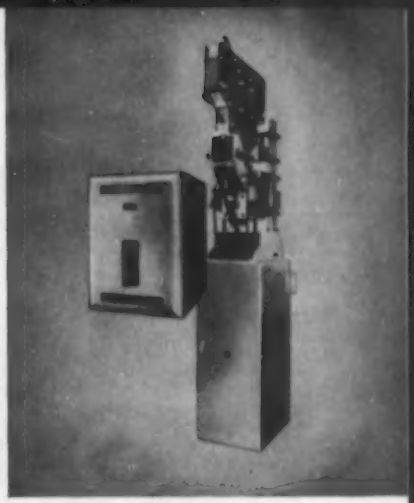
METAL-CLAD SWITCHGEAR

Put I-T-E



UNIT SUBSTATIONS

LOW-VOLTAGE SWITCHGEAR



LARGE AIR CIRCUIT BREAKERS

in your power plans...

for Dependability, Safety, and Over-all Economy

A complete line of Quality Switchgear Equipment

From generation to utilization, I-T-E quality equipment serves every industrial and commercial application. Whether your plans include bus structures, metal-clad or low-voltage switchgear, unit substations, or individual circuit breakers—you are assured of I-T-E's many *extra-service* benefits, which include:

1. selection and application of equipment
2. preparation of specifications
3. coordination of all job requirements

Power is fundamental in any new plant construction or expansion. Power distribution systems must be planned to assure maximum dependability of service, safety for personnel and equipment, and *over-all* economy—from initial planning . . . through the life of the equipment.

Furthermore, it is important to plan power systems with an eye to the future. They should be adaptable to changing plant requirements for many years ahead.

For these reasons, it pays to include I-T-E quality products in your power plans. For over 65 years I-T-E has set the standard for the industry—through engineering skill, design refinement, and introduction of new ideas and thinking.

For details, contact the I-T-E field office nearest you. Look in your classified telephone directory under "Electrical Equipment."

THE SYMBOL OF QUALITY SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

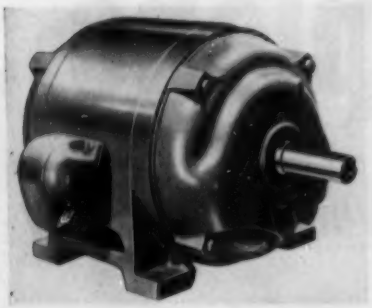
SWITCHGEAR PRODUCTS

Circle 511 on Reply Card for more data

new equipment

—Starts on page 8

(recorder or indicator), and a controller. Each unit can be installed on the process at the point where it operates best, thus providing flexibility of application. The instruments measure, indicate, record, and control pressure, vacuum, temperature, liquid level differential pressure, and flow. The system is said to reduce design engineering problems to make it possible to do all maintenance work in the shop, and to keep a process operating with a minimum of "down time" due to instrument maintenance.

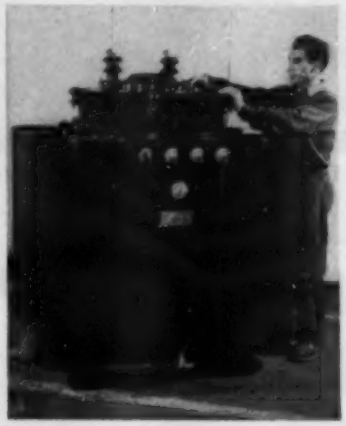


Grease replaced without disassembling motor

D31 Type H Uniclosed motor announced by U. S. Electrical Motors Inc. features completely drip-proof design in the new NEMA 182 and 184 frame sizes. The slot design of the laminations has been improved and the asbestos-protected windings, an exclusive feature, have been reinforced and strengthened by the addition of Mylar laminations. Lubriflush lubrication of the bearings provides means of replacing old grease with new without the necessity of disassembling the motor or disturbing the bearings. The air intake is so designed as to avoid pick-up of dirt and dust from the floor.

Thin wall tubing has high strength

D32 For industrial uses where corrosion resistance, light weight, and special shapes or bends may be required, Flexonics Corp. has developed a high strength thin wall stainless steel tubing. The company will engineer special applications of the tubing in combination with fittings and its own flexible tubing or expansion joints. It comes in 13 outside diameters, from 1.5 to 6 in. All but the smaller sizes are available in four wall thicknesses designed for various pressures.

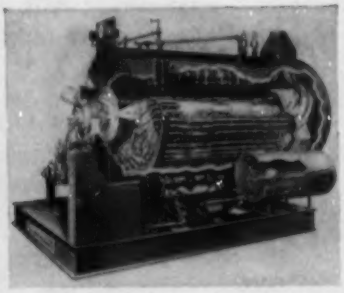


Transformer features new cooling method

D33 Substation-size transformers featuring a new cooling method and reductions in weight and height have been announced by General Electric Company's Distribution Transformer Dept. The cooling method utilizes chimney-type radiators instead of numerous tubes. Weight has been reduced more than six percent and height 2½ ft or more than 30 percent. It is available in ratings of 250-kva, high voltage 15,000 v and below.

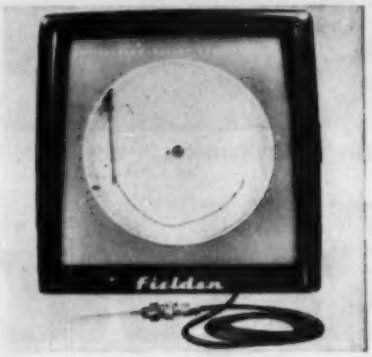
TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.



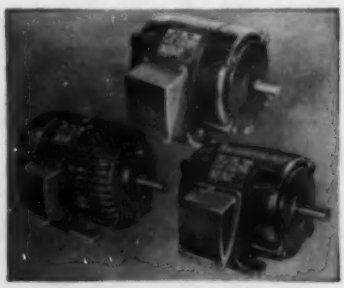
Packaged boilers are available in larger sizes

D34 Orr & Sembower, Inc. announces extension of its Model 4 line of POWERMASTER packaged automatic boilers through 100 hp size. Model designations are 4L for light oil firing, 4G for gas firing, and 4LG for combination gas or oil firing. A three-pass boiler with a single flue gas flow reversal at either end provides maximum convenience to the user for inspection and cleaning thus encouraging "brand new" performance for the entire boiler life. All programming and safety controls are automatic.



Recorder-controllers require no batteries

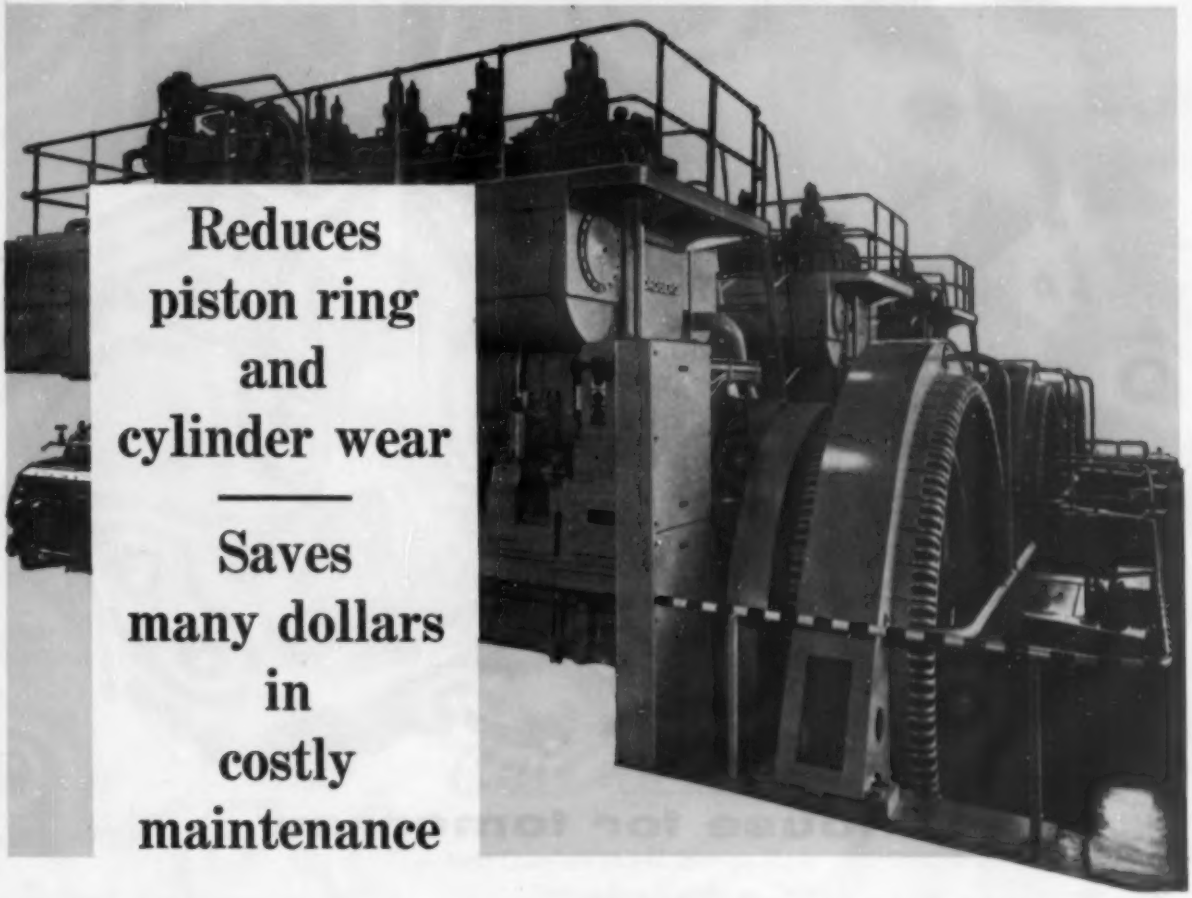
D35 Operating on the null-balance principle using a-c signal actuation, the new line of recorder-controller instruments developed by the Fielden Instrument Div. of Robertshaw-Fulton Controls Co. requires no batteries or standardizing circuits. Applications include recording and control of temperature, conductivity, strain, force, position, pressure, and telemetering. It is composed of only four readily interchangeable units. Nickel, tungsten, and platinum resistance temperature detectors are available, covering temperatures of -328 to 932 F. All except the platinum bulbs feature linearized chart scales.



Motors are quieter and smaller per hp

D36 The Life Line-A designed to offer users longer motor life, greater flexibility in application, and higher reliability as well as decreased size is announced by Westinghouse Electric Corp. It features improved ventilation, better insulation, a more efficient and better protected bearing, and in addition is quieter and smaller per horsepower, conforming to the new NEMA standard dimensions. It

Shell Rotella Oil



Reduces piston ring and cylinder wear

Saves many dollars in costly maintenance

These dual-fuel engines in the Municipal Power Plant at Houma, Louisiana, supply dependable, low-cost electric power to the entire city. Shell Rotella Oil is the cylinder lubricant.

Here's just one of the many diesel power plants that depend on SHELL ROTELLA OIL for reduced wear of engine parts . . . lower maintenance cost.

The anti-corrosive action in Shell Rotella Oil combats the major cause of engine wear . . . cylinder and piston ring wear caused by acid action from the by-products of incomplete combustion and condensation.

Tougher lubricating film in Shell Rotella Oil gives cylinders and rings greater protection . . . minimizes wear. Its effective detergent-dispersant action prevents harmful deposits.

Write for technical information. See for yourself how Shell Rotella Oil can help reduce your engine maintenance costs.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK

100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

Circle 512 on Reply Card for more data

A house for tomorrow

When Bill Miller first talked to the architect about his new home he stressed his desire to put into it the soundest materials and the newest conveniences.

"I hope my grandchildren will be happy in this house," he explained. "New improvements come fast these days, so let's try to be a few years ahead in our planning."

"What fuel would you like to use?" asked the architect when the discussion reached the heating plant.

"I would prefer to use coal," answered Bill, "I understand it is the most economical fuel here, as it is in most areas. But I don't want my wife to be a furnace-tender."

"With a modern, bin-feed stoker with thermostatic control," said the architect, "your heating will be completely automatic, as well as clean and convenient. And coal has some big advantages – it gives a steady heat, not an off-again-on-again heat. Then there's this for the fellow who looks ahead: I don't know how long these other fuels are going to last. Every year they have to drill their wells deeper, and we are becoming more and more dependent on foreign supplies. As these other fuels get scarcer, they are going to get even more expensive.

"But coal is another story. There is plenty of coal right here in the United States to last us for hundreds—maybe thousands of years. That's something to think about when you're planning a house with the hope that your grandchildren will still be living in it."

COAL
FUEL OF THE FUTURE

Chesapeake and Ohio Railway

Bring your fuel problems to C & O

As the world's largest carrier of bituminous coal, the C&O is intimately familiar with every phase of coal use. We have a large staff of experts who will gladly help you to locate the coal best suited to your needs; to help you use it most efficiently; to help get it to you promptly.

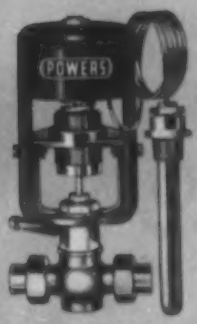
Write to:
Coal Traffic Department
Chesapeake and Ohio Railway
2110 Terminal Tower
Cleveland 1, Ohio

Circle 513 on Reply Card for more data

Above: POWERS ACCRITEM Temperature Regulator, is water or compressed air operated. Controls FLOWRITE diaphragm valve (right). Widely used for Water Heaters and Industrial Processes.

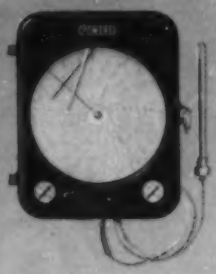
POWERS Type H Thermostatic Water Mixers Insure utmost comfort and safety in showers and other types of baths.

Also used for many processes. Users report ½° F. ± accuracy. Capacities 5 to 10 gpm. @ 45 psi.



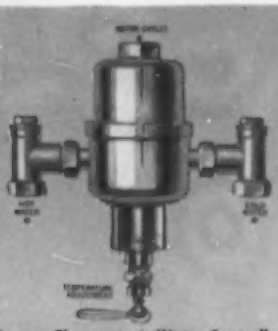
Powers No. 11 Self-Operating Regulator widely used for water storage heaters, heat exchangers, fuel oil preheaters and many industrial processes.

WATER Temperature CONTROL?

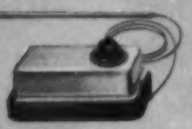


Powers Series 100 Recording Controller. Compressed Air Operated.

POWERS FLOWRITE V-Port-Characterized Diaphragm Control Valve.



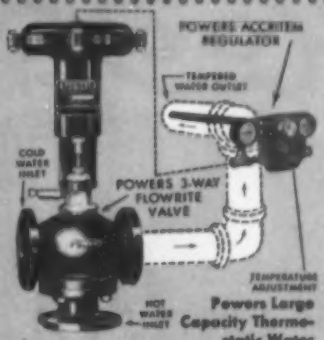
Powers Thermostatic Water Controller for regulating temperature of multiple type showers, hydro-therapy and industrial processes. Capacities 22 to 125 gpm. @ 45 psi.



Powers Remote Bulb Type D Thermostat for Unit Air Conditioners.

POWERS PACKLESS VALVES

For controlling chilled, or heated water in unit air conditioners.
No leakage
No packing maintenance



Powers Large Capacity Thermostatic Water Mixing Valve Controlled by an ACCRITEM Temperature Regulator. Capacities 20 to 1200 gpm. @ 45 psi.

Call POWERS

Most Complete Line of Controls Made Only a few are shown here

for All Types of Baths, Water Heaters and Heat Exchangers

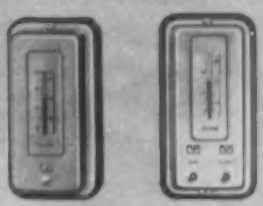
- Forced Hot Water Heating Systems
- Radiant Panel Heating Systems
- Air Conditioning Units using Chilled and Heated Water
- Cooling Water for Air Compressors, Diesel, Gas Engines, and Cyclotrons
- **Many Industrial Processes:** Photo Developing, X-Ray, Color and Ordinary Film, Lens Polishing and Grinding, Chocolate Enrobers, Plastic Molding Presses, etc.

Our More than 60 Years Experience will be valuable in helping you select the right control for your requirements. Contact our nearest office or *Write us direct for Condensed Catalog Rb 24.*

THE POWERS REGULATOR CO.
Skokie, Ill. • Offices in Over 50 Cities in the U.S.A., Canada and Mexico

Powers MASTROL Control for regulating forced hot water heating systems.

Circle 514 on Reply Card for more data



Powers Room Type Pneumatic Controls for Radiant Heating-Cooling Panels, Convectors and Unit Ventilators. Valves are packless. No more packing maintenance. No leakage.

(b81)

more Modern!

more Flexible!

more Adaptable!

than ever before!

the PEABODY

PK-54 BURNER

fully automatic!

To fire oil or gas—or both—with unit capacity to 42,000 lbs. of steam per hour. Industry's most compact, complete, automatic burner, the PK-54 is designed for factory-assembled boilers or conversion installations. Available with steam or mechanical atomization and utilizing the Peabody Wide Range, Constant Differential System. High efficiency, low noise level, and complete accessibility are only a few features of this, the most modern burner in the industry. Literature available on request.

PEABODY ENGINEERING CORPORATION

500 FIFTH AVENUE, NEW YORK 36, N. Y.

Circle 515 on Reply Card for more data

new equipment

—Starts on page 8

is available in three enclosures: totally-enclosed fan cooled, totally-enclosed non-ventilated, and dripproof, as shown from left to right.

Electrode provides high-speed welding

D37 Suitable for many welding operations requiring AWS classes E6012 and E6020 electrodes, a new contact electrode developed by General Electric Company's Welding Dept. is said to be ideal for welding machinery, low pressure storage tanks, and light structural work. In laboratory tests, the new product consistently produced a higher rate of weld footage than conventional electrodes and deposited more metal per unit.

Motor base designed for portable or stationary use

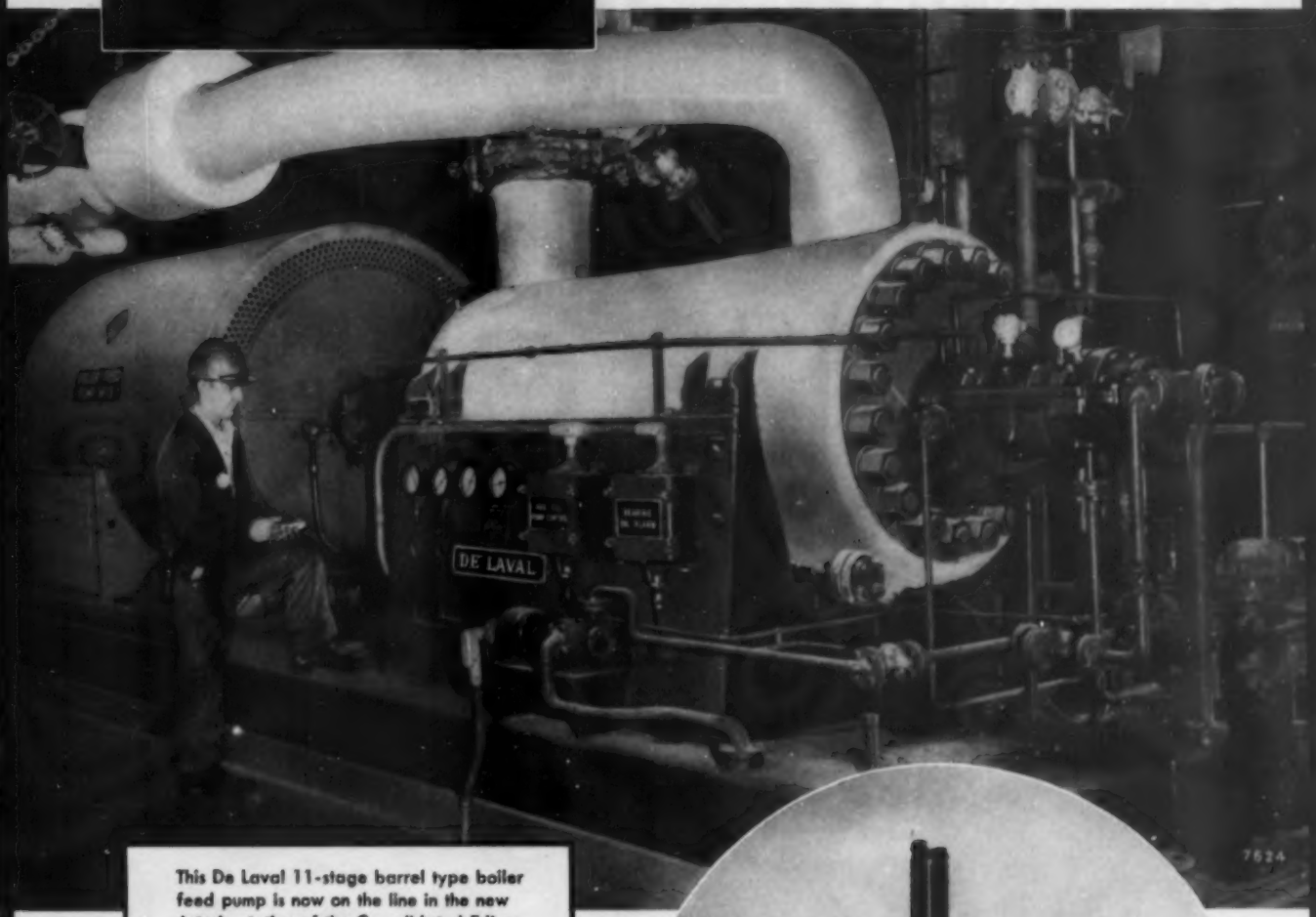
D38 Rodale Mfg. Co., Inc. has added to its line of electrical wiring devices a 10-amp, 2-wire male flush motor base. Listed as Cat. No. 1027, it also comes as a polarized motor base with one narrow and one wide blade (1027P). It is designed for applications in both portable and stationary equipment where a built-in male connector is required, is interchangeable with existing motor bases, and will accommodate interlocking 10-amp 2-wire female cord connectors.

Ultrasonic energy speeds metal-cleaning

D39 "Sonogen" Model 500 Ultrasonic-Power Generator, manufactured by Branson Instruments, Inc., is designed primarily for accelerating

DE LAVAL
BARREL TYPE BOILER FEED PUMP

in new Con Edison Astoria power station



This De Laval 11-stage barrel type boiler feed pump is now on the line in the new Astoria station of the Consolidated Edison Co. of New York.

The De Laval 8/6 pump operates at 129 psig suction pressure and delivers 1,570 gpm of 344 F water against 2,229 discharge pressure. Direct-connected at the end of the boiler feed pump shaft is a De Laval IMO pump for lubrication of the main pump and motor bearings. Also furnished is a motor-driven De Laval IMO auxiliary oil pump with pressure controlled switches. De Laval barrel type boiler feed pumps meet all the requirements of high pressure, high temperature boiler feed service. The distinctive De Laval design assures years of reliable operation with minimum maintenance.

DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY

857 Nottingham Way, Trenton 2, New Jersey

GL-697

Circle 516 on Reply Card for more data

Pipe cooling water into single oil cooler only—this feature of G.E.'s Type DP turbine saves time and extra piping costs in turbine installation.

ANOTHER PLUS VALUE OF G-E MECHANICAL-DRIVE TURBINES...

Single Oil Cooler Saves Extra Turbine Piping Costs

You save on installation costs with a G-E mechanical-drive turbine because General Electric pipes the bearing oil back to a single reservoir for cooling, in a single oil cooler. This eliminates the extra costs of running cooling water piping to and between each bearing. This feature alone can save you up to $50.00.

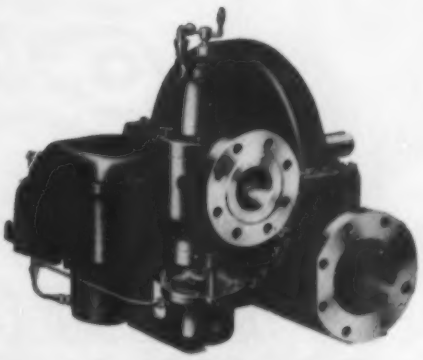
This single oil cooler is just one of the many features on the Type DP turbine which save you money. The chart below indicates other areas of savings.

Remember—the total cost is often more than just the sales price. But G.E.'s standard DP turbines include the extra features that save you extra costs. For more information contact your nearest G-E Apparatus Sales office. Write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." General Electric Company, Schenectady 5, N. Y. 233-66

GENERAL ELECTRIC

INSTALLATION AND MAINTENANCE COST-SAVING FEATURES

THESE EXTRA FEATURES, STANDARD ON ALL G-E TYPE DP TURBINES, CAN . . .	Save You up to
COMBINED TRIP-THROTTLE VALVE Eliminate extra cost of buying and installing valve ahead of the turbine.	$200.00
SINGLE RESERVOIR FOR COOLING LUBE OIL Eliminate extra cost of piping cooling water to and between bearings.	50.00
MAJORITY OF PARTS INTERCHANGEABLE One set of spare parts protects several units—less money tied up in inventory.	100.00
METALLIC-LABYRINTH VALVE STEM BUSHING Eliminate labor costs of replacing soft packings; cut down-time production losses.	50.00
SHAFT MONEL-SPRAYED AT PACKING FIT Saves frequent cost of purchasing and installing carbon rings; contributes to long shaft and packing life.	20.00
ESTIMATED TOTAL SAVINGS	$420.00



G-E Type DP Mechanical-drive Turbine

COMPARE THE FEATURES
EVALUATE ALL THE COSTS

See why G-E standard Type DP turbines are your most economical buy.

Circle 517 on Reply Card for more data

YOU'RE ALWAYS SURE of GREATER ECONOMY... with PREFERRED UNIT STEAM GENERATORS

With a Preferred "Packaged" heating unit you can be sure of—

1. A boiler designed for better performance, built beyond the codes, installed at lower cost.
2. A 25-year investment that pays for itself in one-fifth of its service life through more efficient steam production and greater fuel economy.
3. These Preferred quality features that make all the difference—

- Five Square Feet of Heating Surface per Boiler HP.
- Four-Pass Gas Travel.
- Anti-Stress Deck.
- Intermediate Furnace Position.
- Staggered Tubes.
- Down-Draft Design.
- Induced Draft.
- Expansile Precipitator.
- Dual Purging Action.
- Full Automatic Oil and/or Gas Burners.

Preferred Unit Steam Generators are available in sizes from 20 to 600 B.H.P. and pressures from 15 to 250 psi, to burn oil or gas or in combination.

All Preferred Unit Steam Generators are factory fire-tested before shipment.

GET THE COMPLETE STORY
WRITE FOR BULLETIN 2000

PREFERRED UTILITIES MFG. CORP., 1860 Broadway, New York 23, N. Y.
Dept. SP-2

☐ Please send me Bulletin No. 2000

Name_____

Position_____

Address_____

City_____ Zone_____ State_____

Circle 518 on Reply Card for more data

new equipment

—Starts on page 8

the cleaning and degreasing of small parts and metal objects such as strip, wire, and tubing. It functions by activation of the cleaning solvent in which is immersed the low-voltage ceramic transducer. The radio-frequency output of the generator is 500 w continuously at 450,000 cycles per sec. The transducer converts R-F power to high-frequency mechanical vibrations which are transmitted through the solvent and literally shake dirt and grease loose.

Finish aids pulling of silver dutrax cable

D40 Silver DUTRAX non-metallic sheathed cable can be pulled through joists with half the effort necessary when pulling ordinary cable, according to Anaconda Wire and Cable Co. Known as Type NM it will not become sticky at high temperatures, will not flake off nor peel at low temperatures, and will not mar wall surfaces. It is available in twin-conductor in sizes No. 14 to 8 Awg and in 3-conductor round, in sizes No. 14 to 6 Awg.

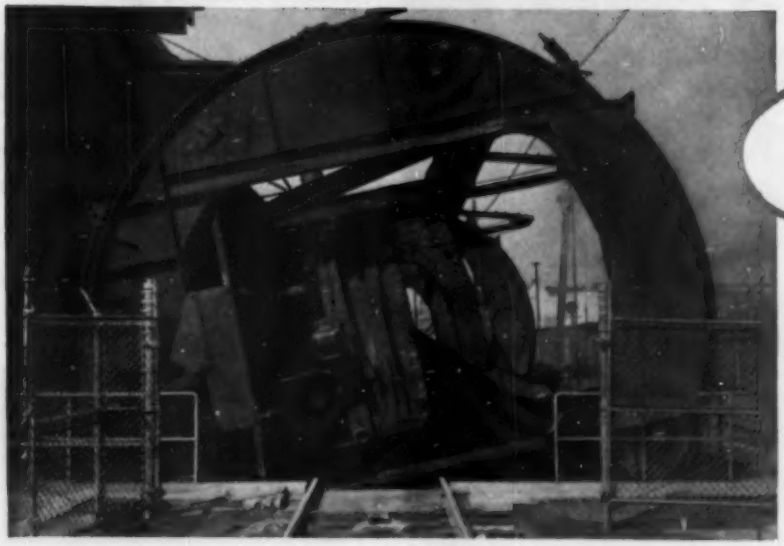
Motors are available in 182 and 184 frame sizes

D41 Klosd normal speed electric motors made by Sterling Electric Motors, Inc. are now available in

Why Link-Belt builds both...

Car Shakers

EASIER ON CARS with minimum noise level . . . thanks to exclusive low-frequency vibration. The Link-Belt Car Shaker helps hopper cars empty themselves. Even hard-packed loads come "broom clean" in a matter of minutes. Especially good for damp, sticky materials. Write for Book 2345.



Rotary Dumpers

BOTTOMS UP . . . empties 90 ton car every 60 seconds or less by simply turning car upside down (including return to upright position)! That's how fast Link-Belt Rotary Car Dumper unloads gondolas. Simple, automatic, foolproof. Takes all open-type cars—any length, width or height . . . up to 90-ton or 120-ton capacity. Book 2048-A has complete data.

Read how you can empty railroad cars fast, gently—at lower cost

YOU'LL get push-button car-unloading with either the Link-Belt automatic Rotary Dumper or the low-frequency Car Shaker. Both of these Link-Belt products can whisk gondola cars "broom-clean" in a remarkably short time.

We build the Rotary Dumper for large users . . . the Car Shaker for smaller operations. That's why you can be sure you get the right railroad car unloader for your particular requirements. Each of these precision-engineered products reduces operational hazards, minimizes injury possibilities, cuts costly demurrage charges.

If you empty a few gondola cars a day—or several thousand a week, call the Link-Belt district office nearest you. Get all the facts on how you can cut your railroad car unloading costs.

LINK-BELT

CAR SHAKERS and ROTARY DUMPERS

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 10,200

Circle 519 on Reply Card for more data

DUAL CONTROL means ECONOMY

with NATIONAL AIROIL Universal Registers

AND TYPE "S-A-L" OIL BURNERS

. . . and economy means that you get better performance with NATIONAL AIROIL Universal Registers because they have a dual feature for controlling air volume independent of turbulence. Air vanes can be instantly reversed to change direction of turbulence while air volume is separately regulated by a refractory faced disk control. Both adjustments can be made while the Type "S-A-L" Oil Burner is firing.

Another "dual advantage" of NATIONAL AIROIL Universal Registers is that they are equipped for dual fuel firing of gas and oil.

Universal Registers with Type "S-A-L" Burners are available in three (3) sizes . . . capacities up to 60,000 lbs. of steam produced per burner per hour. Write for Bulletin 51.

NATIONAL AIROIL BURNER INSTALLATION
BRITISH AMERICAN OIL COMPANY

NATIONAL AIROIL BURNER CO., INC.

1391 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.

Southwestern Division: 2512 South Boulevard, Houston 6, Texas

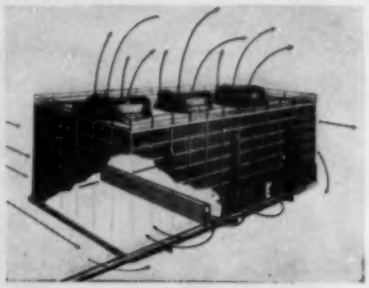
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

Circle 520 on Reply Card for more data

new equipment

—Starts on page 8

frame sizes 182 and 184. Incorporating new NEMA standards, the motors feature new terminal boxes, greater bearing protection, and improved insulation. Larger frame sizes will be in production by late 1955.



Cooling tower design reduces recirculation

D42 To prevent exhausted air from being forced downward into the inlet area and recirculated through the tower, Santa Fe Tank & Tower Co. has introduced Equalizing Channels into large, multi-cell towers. The channels are said to relieve the pressure differential existing between windward and leeward sides. Pressure is thereby equalized on both sides of the tower, and during the presence of strong horizontal winds the channels allow air to pass completely through the tower in order to equalize pressure.

Two fans are added to line

D43 The "LV" (large volume) fan manufactured by Chicago Blower Corp. is available in four sizes with a forward curved wheel of all welded construction which is both statically and dynamically balanced. The "PB" (pressure blower) type utilizes a radial bladed wheel of aluminum alloy. Self aligning, grease lubricated ball bearing pillow blocks are furnished as standard equipment. Bronze sleeve type bearings, impregnated with graphite and having a large wool-packed oil reservoir, can also be furnished at no additional cost. Type "LV" furnishes volumes up to 2124 cfm and pressures to 1½ psi static pressure; Type "PB" furnishes volumes up to 335 cfm and pressures to 4 psi static pressure.

CHROMALOX

Electric Heaters

STRIP HEATERS

In straight lengths, formed or "finned" for conduction or convection heating. Industry's rugged and versatile heat source for many uses.

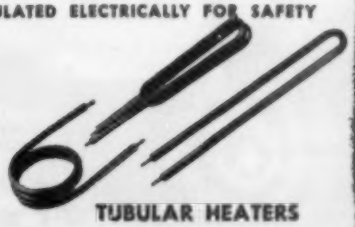
CARTRIDGE HEATERS

Installed in an instant in drilled holes for heating dies, platens, moving parts, rolls, molds, etc. Types available for immersion heating in liquids.

SHEATHED IN METAL FOR STRENGTH—INSULATED ELECTRICALLY FOR SAFETY

IMMERSION HEATERS

For heating water, oil and other liquids. Wide variety of types and sizes for portable or permanent installations, with or without built-in thermostats.



TUBULAR HEATERS

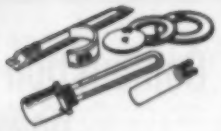
Straight lengths or tailored to any desired shape. For heating liquids, solids or gases by conduction, convection or radiation. Many sheath types.

Your LOW COST SOLUTION to processing heat problems!

Chromalox Electric Heaters give you quick, on-the-spot heat for a wide range of uses. They provide dependable, efficient, economical around-the-clock service in applications requiring continuous, accurately controlled temperatures. Thousands of plants in all industries have found Chromalox Heaters the low cost solution for heating liquids and gases; for heating dies, platens, moving parts; for superheating steam and pre-heating oil; in fact—for almost every industrial application using heat.

CHROMALOX

OFFERS YOU THE MOST IN ELECTRIC HEAT



Selection . . .

Over 15,000 types, sizes and ratings fill most applications needing heat up to 1100° F.

Engineering . . .

Research, development and technical personnel provide a vast reservoir of industrial heating know-how.

Experience . . .

World's largest manufacturer of electric heating units exclusively. 35 years of designing and manufacturing skills.

Service . . .

Over 130 field engineers in 36 key cities give on-the-job assistance and counsel.

10-76

CHROMALOX

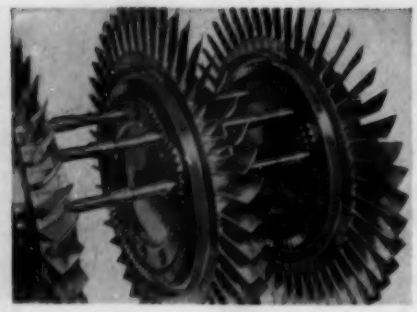
Electric Heat for Modern Industry

YOURS
without obligation

Catalog 50 is a storehouse of valuable information and data on many of the 15,000 Chromalox Electric Heating Units. Write today for your copy.

EDWIN L. WIEGAND COMPANY, 7520 THOMAS BOULEVARD, PITTSBURGH 8, PA.

Circle 521 on Reply Card for more data



The turbine rotor is a set of interlocking discs held together with Inconel "X" bolting. The forged Inconel "X" blades fit into pine-tree grooves machined axially on the discs. The blade contours provide for maximum conversion of heat energy into work; the use of Inconel "X" assures dependable performance under high temperature conditions.

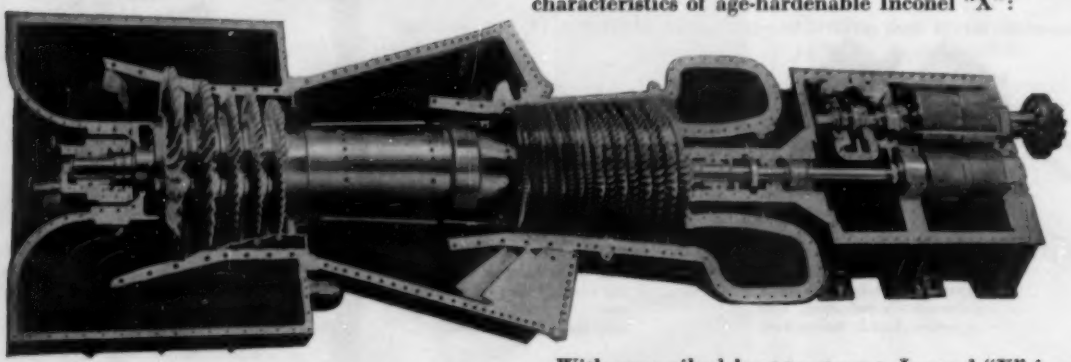
Combustion gas turbine power plants— have they a place in your future?

The combustion gas turbine is past the experimental stage. It's a new source of power for mechanical drive applications.

Many problems, of course, had to be worked out before the new turbine got to where it is today. The problem of metal failure at high temperatures, for example, caused trouble time and again.

But now the WESTINGHOUSE ELECTRIC CORPORATION has a practical answer. This major turbine builder is using Inconel "X" for blading and high temperature bolting. Inconel "X" provides the longest periods of uninterrupted service at the lowest cost yet achieved.

If you want to know why, just look at some of the principal characteristics of age-hardenable Inconel "X":



Converts gaseous or liquid fuel directly into mechanical power. This Westinghouse 7000-hp gas turbine plant is of the simple open-cycle type. Its three major components, axial flow air compressor, combustion system and gas turbine, are contained in a single casing assembly. Rotor blades are forged from Inconel "X" bar stock. The bolts holding rotor discs together are also Inconel "X". (See photo above.)

With prescribed heat-treatment, Inconel "X" is one of the most useful alloys available for service at 1350° to 1500°F. It has good creep strength and excellent resistance to oxidation at these high temperatures.

Its stiffness, or modulus of elasticity, is about equal to that of alloy steels. Its resistance to impact is good, too. And it can be forged, fabricated and machined, can be welded by all the commonly used processes.

What's more, Westinghouse engineers have found Inconel "X" a good commercial quality material with little variation from melt to melt. That's because Inconel "X" is a standard alloy which Inco has produced steadily for a number of years.

Whether combustion gas turbine power plants figure in your immediate future or not, you'll do well to remember Inconel "X". It could very likely be the metal best suited to solve a high temperature problem in *your* plant. Don't hesitate to call on Inco's Technical Service Section for any information and help you want. There's no obligation, of course.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK

Inco Nickel Alloys

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL
"S"® MONEL • INCONEL® • INCONEL "X"® • INCONEL "W"® • INCOLOY®
NIMONIC® Alloys • NICKEL • LOW CARBON NICKEL • DURANICKEL®

Circle 522 on Reply Card for more data

COPPUS "BLUE RIBBON" VENTILATORS

Identified by the blue band

FOR WORKERS'

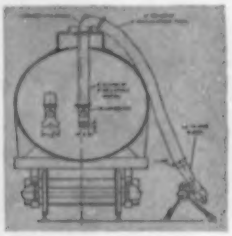
- Safety
- Health
- Comfort
- Efficiency

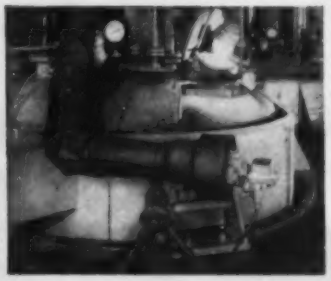
VANO® Design "A" VENTILATOR

Vano Design "A" cooling interior of furnace, supplying fresh air through 10 feet of "Ventube" to provide safety and comfort during repair work.

Vano Design "A" delivering fresh air to cable manhole, expelling sewer gas, making entrance safe in a few minutes.

Vano Design "A" Ventilator plus a few accessories feeds large air volume into tank car, driving out fumes, stagnant or hot air for workers' safety and comfort.





Vano Design "A" supplying fresh air in Reactor Room of Synthetic Rubber Plant.

Vano Design "A" Ventilator supplying fresh air to men working in wing compartments, fuselages, etc.

Powered by a ½hp motor, and equipped with the exclusive Coppus axial-flow propeller-type fan, this general-purpose blower delivers 1500 CFM of fresh air. It supplies ventilation for tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments and fuselages, and other confined places. Weighs only 103 lbs. Uses 8"-diameter flexible canvas tubing ("Ventube").

VANO DESIGN "C"

VENTILATOR-EXHAUSTER

Vano Design "C" equipped with 8" discharge tubing removing welding fumes.

Vano Design "C" equipped with two suction lines removing welding fumes for operators' safety.

For withdrawing welding fumes from confined places or directly from the welding rod ...or for expelling fumes or hot air from enclosed vessels. You can get it with 8" suction inlet for 8" non-collapsible tubing ...or with multiple inlet nozzles for 5", 4" or 3" suction hose. The discharge outlet takes 8" "Ventube". Powered by a ½ hp motor, it weighs only 85 lbs.

COPPUS ENGINEERING CORP., 184 PARK AVENUE, WORCESTER 2, MASS.
Please send information on the Blowers that clear the air for Action.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuselages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.

NAME .....

COMPANY .....

ADDRESS .....

CITY .....

(Write here any special ventilating problem you may have.)

COPPUS "BLUE RIBBON" PRODUCTS—Designed for Your Industry, Engineered for You

Circle 523 on Reply Card for more data

CON EDISON SELECTS...

The control gage board for Astoria's No. 10 boiler. At top: Hays Model WSF for mounting above eye level. Right center: Hays Model WCF8P for eye level. Four mounting styles are available to meet special requirements.

NEWEST TYPE **Hays Draft Gage**

Consolidated Edison's new Astoria Electric Generating plant at Queens, N.Y. is equipped specifically for the purpose of producing electricity at the lowest cost per kilowatt, reliably and continuously.

To meet these exacting requirements, Con Edison selected Hays W Gage . . . a completely new design in draft gages. Like other Hays low pressure instruments, the draft gage operating mechanism consists of a diaphragm enclosed in a cast metal housing. For pneumatically transmitted readings of Air, Steam, or Water Flow, Pressures, Temperatures, Levels, Oxygen, etc., the operating mechanism employs a bellows. The outstanding new features include: 3-way atmospheric vent cock, easy zero check, removable units for simple adjustment, and Lucite scales for easy reading.

Functionally designed and beautifully styled, the Hays W Gage provides exactly what instrument men have long demanded—an easily adjusted, easy-to-read, dependable draft gage!

Write today for full information on the Hays W Gage. Publication 52-1060-210.

Automatic Combustion Control
Boiler Panels • CO_2 Recorders
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

THE **hays** CORPORATION

MICHIGAN CITY 2, INDIANA

Circle 524 on Reply Card for more data

new bulletins

. . . catalogs from leading manufacturers

200—Jacketed Valves

Data sheets 220 and 221 describe operational features of this company's jacketed valves which are for heated-cooled gages or wherever small jacketed angle valves are required. Full specifications are given. Cut-away views show internal construction. Jerguson Gage and Valve Co.

201—Light-Weight Pipe

As a practical help to pipe users, this company has issued bulletin 507 showing typical applications of its light-weight lockseam-spiralweld pipe and fittings. Included are standard specifications on pipe from 4 to 30 in. in diameter, together with data on fabricated fittings, flanges, and connections to meet all pipe line requirements. Naylor Pipe Co.

202—Metal Chain

"Why You Should Use Rex Z-Metal Chain," 10-page booklet 53-56, gives results of laboratory tests and field applications under severe service conditions. Tables compare mechanical properties and corrosion resistance of Z-Metal with malleable iron and stainless steel. Types of chains are shown. Chain Belt Co.

203—Catalog

Fan and blower catalog No. 600, 18 pages, includes this company's bulletins 601 to 618 inclusive. Each bulletin gives specifications, certified ratings, and dimensions for a different type of fan or blower. Methods of installation, photographs, and engineering drawings are included. Chelsea Fan and Blower Co., Inc.

204—Lagging Adhesive

Technical bulletin 5307, four pages, describes Adhez-A-Kote lagging adhesives and coatings for shrinking, sizing, bonding, and protecting insulation lagging fabrics. It outlines features of the product, pictures typical installations, and provides an actual sample of treated lagging fabric. Complete data on proper application is included. General Paint Corp.

205—Steam Jacketed Valves

"Viscous Materials," four-page folder E-200 will be of special interest to engineers of plants in which viscous materials are handled. Illustrations of steam-jacketed valves include a large cross section and an exploded view together with views of typical installations in which these valves are giving satisfactory operation in difficult services. The bulletin also contains a table of dimensions for valves in sizes 1½ to 6 in. inclusive and for pressures up to 150 psig. Everlasting Valve Co.

206—Fuel-Oil Control

Latest data on fuel-oil heating and pumping sets are contained in 27-page bulletin OB-53. It outlines the principles used in design and construction and gives a complete form to help engineers in drawing up comprehensive specifications for bidding. Photographs illustrate the various combinations of pumps, drivers, and heaters as well as a wide range of piping arrangements for cross-over controls and suitable locations of valves, gages, and thermometers to suit special unit locations and control requirements. The Engineer Co.

207—Rubber Lining

Advantages and applications of rubber lining to steel tanks, drums, pipes, valves, fittings, and pumps are described in an eight-page bulletin. Important tables give the resistance characteristics to inorganic acids, salts and alkalies, organic materials, and many other solutions. Plant facilities for cementing, lining, and vulcanizing all types and sizes of equipment are illustrated, and the B. F. Goodrich Vulcalock Bonding Process, which joins rubber and steel together with a bond strength of over 500 psi is described. Protective Coatings Div., Metalweld, Inc.

208—Vacuum Cleaning

Basic working elements of permanently installed vacuum cleaning systems with central dust collection are explained in detail in 11-page bulletin A-930. Function of portable separators, water traps, material intake valves, electric bag shakers, and rotary discharge valves is explained. Five questions cover preliminary data required for the design of any plant vacuum cleaning system. Air Appliances Div. of U. S. Hoffman Machinery Corp.

Cooling Towers

"Cooling Tower Wood Maintenance," 13-page bulletin TSC-302, is a summary of work done and conclusions reached to date as a result of a joint study on the subject by the Cooling Tower Institute and the California Redwood Association. Photographs of several typical samples of degraded material have been included as a visual aid to users and manufacturers in their early detection of cases of deterioration. **Please send requests directly to Cooling Tower Institute, 444 Emerson St., Palo Alto, Calif., on company letterhead.**

209—Transformers

"G-E Instrument Transformer Buyer's Guide," 1954 edition, GEA-46266, 96 pages, contains ratings, ASA accuracy classifications, and prices of all G-E indoor and outdoor potential and current transformers. Listings of ratio and phase-angle tests, together with tables covering the mechanical and thermal limits of current transformers, are included. General Electric Co.

210—Valves

Blow-off valves for boiler pressures up to 400 lb wsp are described in 20-page bulletin B-426. It contains full details of Yarway Seatless Blow-Off Valves and Yarway Double-Tightening Blow-Off Valves. Additional information includes installation recommendations, construction details, and prices. Yarnall-Waring Co.

211—Cell Transmitters

Six-page technical information sheet T127-A-23b, describes electric d/p cell transmitters, which translate small differential pressures into electrical measurements of flow or level for instrument recording or control. Helpful in determining the suitability of pressure transmitters to specific process conditions is a list of cell specifications, including the different types of diaphragm materials available and the various ranges obtainable. Also included are static and overrange pressure limits, frequency response, volumetric capacities and displacements, and circuit diagrams showing methods of compensating the cells for temperature effects. The Foxboro Co.

212—Motor Starters

GEA-6061, six-page bulletin provides buying information on a-c magnetic motor starters (1/6 to 50-hp), a-c combination starters (½ to 25-hp), push-button stations, a-c manual motor starters, and magnetic reversing controllers. In addition to ratings, the publication contains photos of the equipment, circuit diagrams, and brief application data.

213—Air Washers

Capillary Air Washers for cleaning, cooling, humidification, and dehumidification are discussed in nine-page bulletin 4123. Each component of the system is pictured and described. Sample problems for each type of service are worked out. Blue-print drawings show dimensions. American Blower Corp.

214—Cross-Flow Cooling

Based on the experience of more than 25 years in designing, producing, and testing all types of mechanical draft cooling towers, this 30-page brochure presents the case for cross-flow cooling as the method that offers the greatest number of advantages. Cross-sectional drawings illustrate principles of operation of single, double, and twin-flow units. Design features are pictured and explained by means of photographs. The Marley Co.

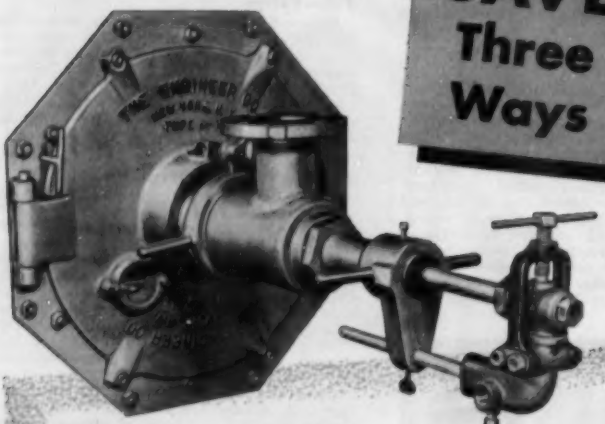
215—Water Heating

Help in solving today's heating problems and planning ahead is offered in 16-page bulletin 100, "Hydrotherm." Applications of high temperature high pressure water in distributing heat to large area installations such as district heating, airports, hospitals, schools, shopping

NOTE—Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 34/35 & 98/99.

ENCO
Interchangeable Atomizers

SAVE Three Ways



Gun Type Gas-Oil Burning Unit

These units offer money-saving flexibility in three important ways:

1. They can be used with oil, gas—or both.
2. They assure completely uniform combustion—and greater fuel economy—even when steam demands fluctuate widely, and suddenly.
3. They can be used with natural or forced draft.

Ask for 28-page Bulletin OB-53 giving complete details of these and other fuel-burning units.

Enco Wide Range Mechanical Atomizer Gun

Enco Standard Range Mechanical Atomizer Gun

Enco Wide Range Steam Atomizer Gun

Enco Standard Atomizer Gun Support

Enco Gas Burning Gun

THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, N. Y.

Canada: Rock Utilities Ltd., 80 Jean Talon St. W., Montreal, P. Q.

EC505

Circle 525 on Reply Card for more data

new bulletins

—Starts on page 35

centers, housing projects, and industrial building groups are discussed and illustrated. Advantages of high temperature water heating over steam heating are pointed out with comparison of pipe lines and repairs and maintenance needed for each type system. American Hydrotherm Co.

216—Boilers

A handy 16-page reference bulletin SB-50 describes this company's complete line of steam generating equipment. Sectional views and photographs are used to show various arrangements of equipment with an explanation of advantages and applications. Erie City Iron Works.

217—Outdoor Boiler

Eight-page bulletin R-10 gives an account of Morton Salt Company's "exposed" steam generator at Manistee, Mich. Featuring air flow, steam flow compensated Hays combustion control, the boiler is described as handling load swings up to 80,000 lb per hr at 85 percent efficiency. Photographs explain operation of the control system. Hays Corp.

218—Motor Control Center

Savings in space and expense and improved performance is explained in 12-page bulletin 170. Electrical and constructional details of these groups of combination motor starters and their components are fully described. Size, rating, and ordering data are included. Arrow-Hart & Hegeman Electric Co.

219—Pneumatic Transmitter

Four-page booklet 2753 gives construction details and a cut-away view showing the specially designed no-sealing-fluid measuring assembly of a low-head type differential-pressure pneumatic transmitter. Economy of air consumption, and simplicity of calibration are explained. Hagan Corp.

220—Rotary Joints

Construction and operation of ball-and-socket type Phillips Rotary Joints are described in four-page bulletin. Designed to permit transfer of liquid or steam into or out of any revolving drum, the socket is described as available in either the Thru-Flo style, for drums having two outlets; or in the Syphon style, for installations where inlet and outlet is desired in the same unit, or for syphon drainage of condensate from the steam chambers of a roll or drum. Key Co.

221—Compressed Air

"Moisture Control in Compressed Air," four-page brochure, discusses types and quantities of impurities and methods for their removal. The Vi-Speed method, units, and dessicant are clearly described

Engineered for the Textile Industry

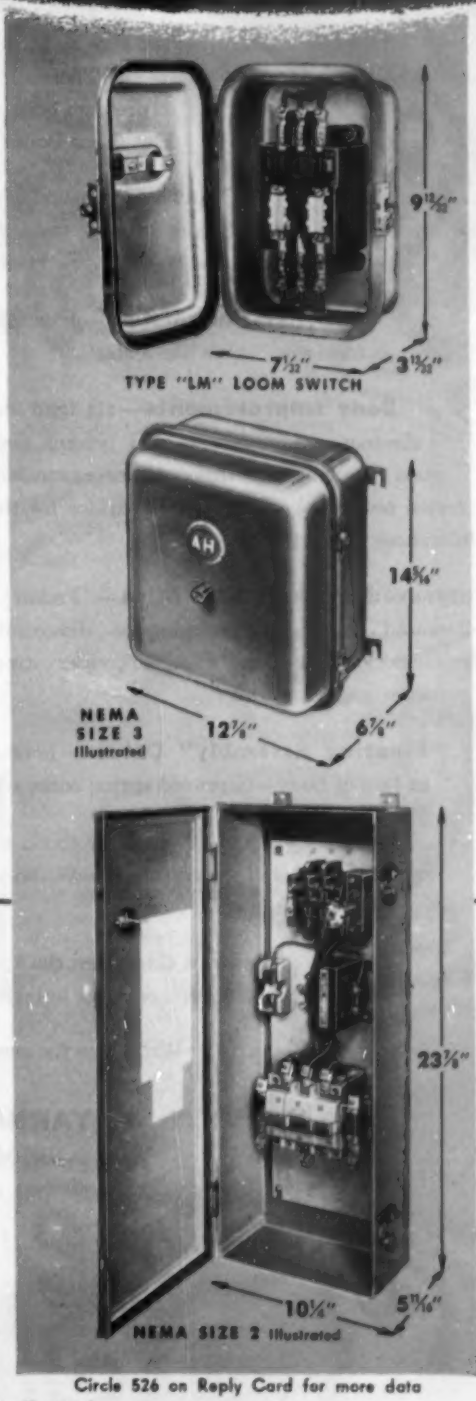
3 NEW DEVELOPMENTS IN MOTOR CONTROL

ARROW AH HART

All

OFFERING THESE IMPORTANT ADVANTAGES

- **DOUBLE PROTECTION AGAINST LINT . . . and other breakdown materials**
- **GREATLY REDUCED FIRE HAZARD**
- **SUPERIOR PERFORMANCE and DEPENDABILITY**
- **LONGER LIFE**
- **SMALLER SIZE and WEIGHT . . . saving valuable space**
- **FASTER, EASIER INSTALLATION and MAINTENANCE**
- **SAFER, MORE CONVENIENT OPERATION**



TYPE "LM"

Loom Switch

Size 0, 3 pole, 2 hp to 600 volts a-c. Completely new, radically different . . . not just an adaptation of a standard switch. Unique, built-for-the-purpose rotary overload mechanism resists shock far in excess of any found in actual loom installations. Fully enclosed switch unit plus lint proof enclosure provides double protection against lint.

NEMA TYPE XII

Enclosure for Magnetic Starters

For starter sizes 0, 1, 2 and 3. Used wherever switch ratings exceed 2 hp . . . or remote control is desired. Enclosures with heavy neoprene gaskets protect effectively against lint. Smaller, lighter A-H Type "RA" (Right Angle) Starters provide superior performance, dependability. Vertical contacts offer added protection by preventing accumulation of breakdown material.

NEMA TYPE XII

Combination Starter

Smaller and lighter than any other combination starter of comparable rating, the "RAC" offers the advantages of the unique A-H Type "RA" Starter plus the exclusive new A-H "RAD" Disconnect *plus* the all new A-H enclosure that provides full protection against lint and other breakdown materials. Available in Sizes 0, 1 and 2 with fused or unfused disconnect or with circuit breaker.

The Arrow-Hart Controls shown have been designed and constructed throughout specifically for the operating conditions peculiar to the textile industry. Standards for safety, performance and ease of installation and maintenance were determined, met and exceeded in all these Arrow-Hart Motor Controls. Be sure to request a copy of "Electrical Controls for the Textile Industry" . . . complete with product, application and engineering data.

SINCE ARROW AH HART 1890

SEND THIS COUPON TODAY

Your Folder Will Be Mailed Promptly

INDUSTRIAL CONTROL DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC CO.

103 HAWTHORN ST., HARTFORD 6, CONN.

Please send my free copy of "Electrical Controls for the Textile Industry."

NAME_____

POSITION_____

COMPANY_____

CO. ADDRESS_____

CITY_____

ZONE_____ STATE_____

IP-4

Circle 526 on Reply Card for more data

LOOK WHAT'S HAPPENING TO BOILER WATER GAGES.

● There's a "new look" in water gages for high pressure boilers. You'll find it in every new YARWAY Flat Glass Boiler Water Level Gage.

YARWAY design and development engineers have made *twelve distinctive improvements* in YARWAY gages. All contribute to improved water gage service, longer water gage life.

Better Illumination—improved mercury vapor illumination makes meniscus "shine like a star".

Body Improvements—flanged connections and expansion bends eliminate stuffing boxes and *prevent distortion*—separated design in four-glass inserts permit freedom for expansion—stainless steel facing for gasket recess provides corrosion proof surface for the higher pressures—close machining tolerances insure top quality.

Improved Gaskets and Mica—"Frelon" gaskets are coated with a special compound to prevent sticking at disassembly—wire inserts for the higher pressures give "Frelon" gaskets greater strength—thicker mica for the higher pressure gages.

"Floating Assembly" Covers—improved capscrews have wider shoulders at face of body—improved spring cones reduce spring cone stresses.

Better Valves—YARWAY Welbond gage valves have integral stellite seats and stainless steel stems—Welbond water column shut-off valves have lock-open device.

YARWAY Gages are the "gages to see" on all new boiler units or replacements in high-pressure installations.

Write now for new YARWAY Bulletin WG-1812.

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY Flat-Glass Water Gage Assembly with four-glass double insert for long ranges of visibilities.

Note separated design, interconnecting expansion loops, flanged connections (1½" tie-bar-type circulating water column) and Type "M" Illuminators that make meniscus at water level "shine like a star".

YARWAY Single Insert type gage for medium range of visibilities. Note expansion loop and flanged connections. YARWAY Welbond Gage Valves assure highest dependability in high-pressure service.

Close-up of YARWAY Type "M" Illuminators on above 4-glass insert assembly. The blue-white illumination is visible for distances up to 125 ft. and is especially effective in penetrating deposits on gage glasses, dust particles in the air and extraneous light.

YARWAY

water columns and gages

Circle 827 on Reply Card for more data

HOFFMAN
VACUUM PUMPS
WITH PEAK WATER CAPACITY 280% OF RATING

Automatically removes air and water from heating units, maintains a vacuum in the returns, and delivers condensate to the boiler

The new type Hoffman Vacuum Pump on official test performed as follows: When started cold, the air capacity was 300% of rating. When air was exhausted and the flood of initial condensate reached the pump, it was removed at the astounding speed of 280% of rated capacity. At 160° water temperature and 6" vacuum, pump capacity was 100% for simultaneous removal of air and water. Note the simultaneous performance!

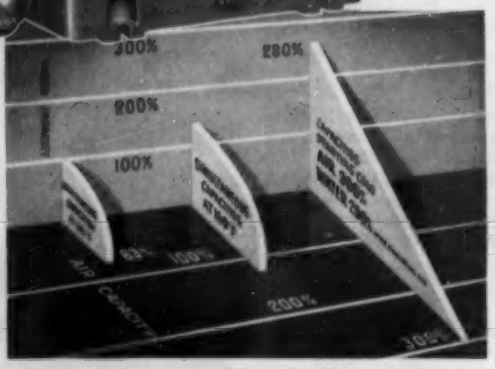
At 195° water temperature and 3" vacuum, the pump discharged 83% of rated capacity in air and 100% in water.

CAPACITIES:
From 2,500 to 100,000 sq. ft. EDR

DISCHARGE PRESSURES:
From 20 lbs. to 60 lbs. per sq. in.

- Bronze fitted throughout
- Enclosed, precision balanced bronze impeller
- Renewable bronze wearing ring
- Split bronze packing gland
- Stainless steel impeller hub
- Impeller has top suction inlet—eliminates air or vapor binding
- Rigid motor support, very quiet
- Easily handles 200°F condensate

Write today for Cat. No. VP 853, no obligation



These Hoffman performance figures defy comparison. Remember, too, that all this super-efficiency is available at lower maintenance cost due to the featured Hoffman Jet-Type Vacuum Producer.

[redacted]

new bulletins

—Starts on page 35

along with results that can be anticipated. Specifications are listed for four models of the self-cleaning process. Van Products Co.

222—Photocopying

Information kit gives complete information on the Apeco Systematic Auto-Stat for photocopying letters, reports, contracts, and other important records. How it cuts costs up to 80 percent by eliminating re-typing and checking is explained. Advantages such as turning out dry copies in 45 sec, and ease of operation are described. Kit includes folders on copying tax returns, color copying, and copying pre-printed forms. American Photocopy Equipment Co.

223—Pumps and Compressors

How this company's industrial equipment can be used in many different types of industry is explained in 15-page reference bulletin WP-1099-B61. Special features, types, sizes, and capacities of products from condensers and coolers to rotary and centrifugal pumps are listed and pictured in actual installation photographs taken at steam power plants, refrigerating plants, and others. Worthington Corp.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.

224—Aluminum Jacketing

One of the most frequent problems in the use of aluminum jacketing on insulated lines is how ells, tees, and bends should be weatherproofed. Data Sheet E-130 answers this question with a drawing which shows three practical methods for this part of the job. Childers Manufacturing Co.

225—Solid Shaft Drives

Typical solid shaft installations for right angle gear drives are pictured in four-page folder 26. A cut-away drawing is labeled to show the salient features and construction. Custom products such as dual drives are listed along with gears made to individual specifications. Johnson Gear and Manufacturing Co., Ltd.

226—Service Guide

"Steam Trap Service Guide," 32-pages pocket-size reference booklet, includes information on how to install traps, testing, preventive maintenance, inspection and repair, and trouble shooting. Two-page graph "Pounds of condensate per hour," shows the actual capacity of this company's traps, continuous discharge. Armstrong Machine Works.

227—Oil-Tight Equipment

Operation and uses for oil-tight push buttons, indicating lights, selector switches, and accessories are described in 16-page bulletin GEA-5779B. Included are cross-sectional drawings, application photographs, dimension and outline diagrams, and complete ordering information. General Electric Co.

(Continued on page 102)

Circle 528 on Reply Card for more data

$ave Power and REFRIGERATION COST

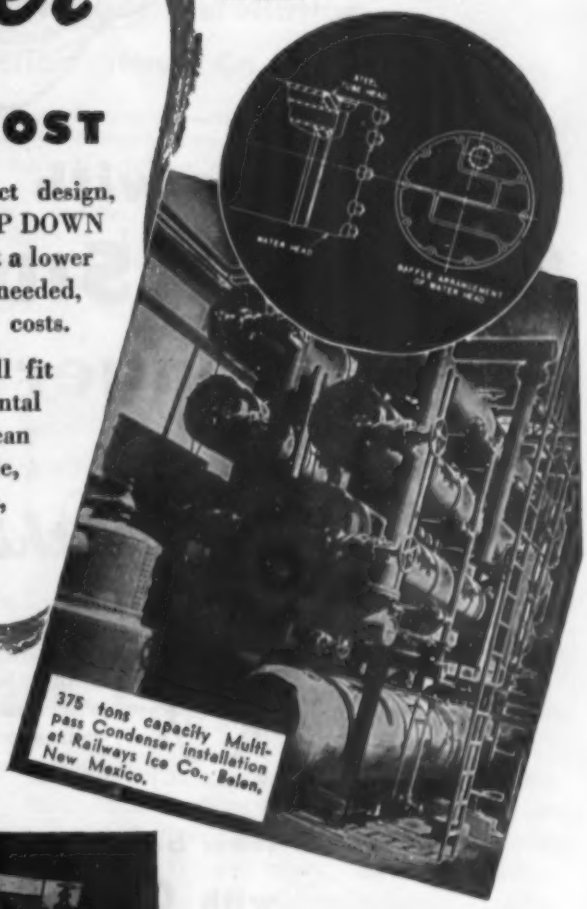
Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

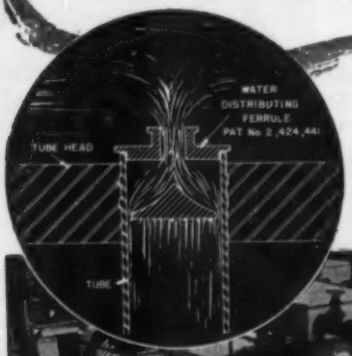
Horizontal Multipass Condensers

(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.



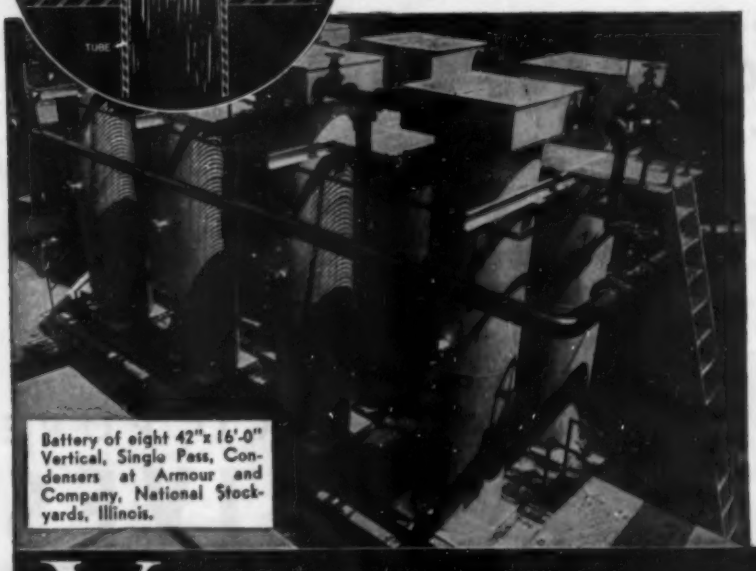
375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.



Vertical Single Pass Condensers

(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.



Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-2

HENRY VOGT MACHINE COMPANY
INCORPORATED
1000 W. ORMSBY ST., LOUISVILLE 10, KY., U.S.A.
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

Vogt REFRIGERATION CONDENSERS

Circle 529 on Reply Card for more data

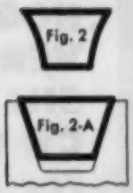
Why V-Belts with CONCAVE SIDES Last Longer!

(U.S. PAT. NO. 1813898)

Prove this yourself!

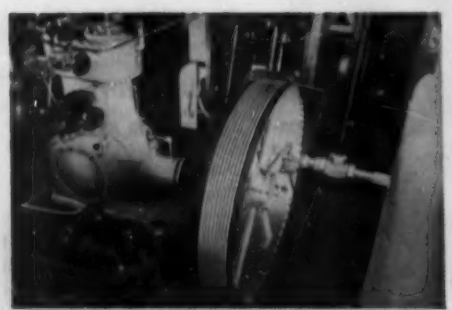
Take any *straight-sided* V-Belt (Fig. 1). Bend it—as it bends in going around a pulley. The sides will at once *bulge out* (Fig. 1-A). Clearly, those bulging sides will press *unevenly* against the V-pulley—and this causes *extra wear* at the points shown by the arrows (Fig. 1-A).

Now bend a Gates Vulco Rope with CONCAVE SIDES (Fig. 2)



Instead of *bulging*, the precisely engineered CONCAVE SIDES merely *fill out* to *fit exactly* in the sheave groove (Fig. 2-A). The sides press *evenly* against the V-pulley. All wear is distributed *uniformly* across the *full width* of the Gates Vulco Rope—and this means *longer* belt life and *lower belt costs* for you!

When you buy V-Belts, be sure to get the V-Belt with the CONCAVE Sides—the Gates Vulco Rope!



Typical Gates Vulco Rope Drive—the Gates V-Belts are built with Concave Sides to insure longer belt wear.

Gates VULCO ROPE DRIVES

REG. U. S. PAT. OFF.

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

THE GATES RUBBER COMPANY
DENVER, U.S.A.

CO-541

Circle 530 on Reply Card for more data

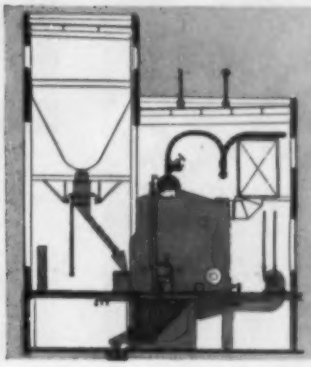
"74.2% MORE STEAM PER DOLLAR—

that's what this modern coal installation gives us at Perfection Stove Co.!"

says George I. Chittenden, consulting engineer for the Perfection Stove Company.

Perfection's old installation, if operating today, would generate 1,362 lbs. of steam per hour per dollar. The new plant produces 2,373 lbs. of steam per hour per dollar. Here's proof of the economy and efficiency of bituminous coal burned with modern equipment.

This view of Perfection Stove's new steam plant shows the coal elevator and ash silo. Coal is delivered through an under-track hopper, lifted by elevator to storage. A pneumatic system carries ashes to the silo.



This sectional drawing of the plant's boiler installation shows the coal bunker over the firing aisle. A weigh larry with dust-proof connection feeds coal to the stokers. The plant is clean and efficient—typical of the modern design that makes full use of coal's inherent advantages.

If you operate your own steam plant, you can't afford to ignore these few down-to-earth facts!

COAL is in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

● More and more consulting engineers are advising their clients that *bituminous* coal is the best buy for steam fuel. *Here's why:* Nearly everywhere coal yields more BTU's per dollar . . . modern combustion installations step up this inherent economy . . up-to-date coal- and ash-handling systems cut labor costs to a minimum.

Tremendous reserves give coal a future dependability of supply no other fuel can offer. And to mine this coal, America has the world's most productive and efficient coal industry—making coal the one fuel most likely to remain reasonably stable in price.

If you're building or planning to modernize a steam plant, call in a competent consulting engineer. He'll show you how a modern coal installation can save you money and do a more efficient job, too!

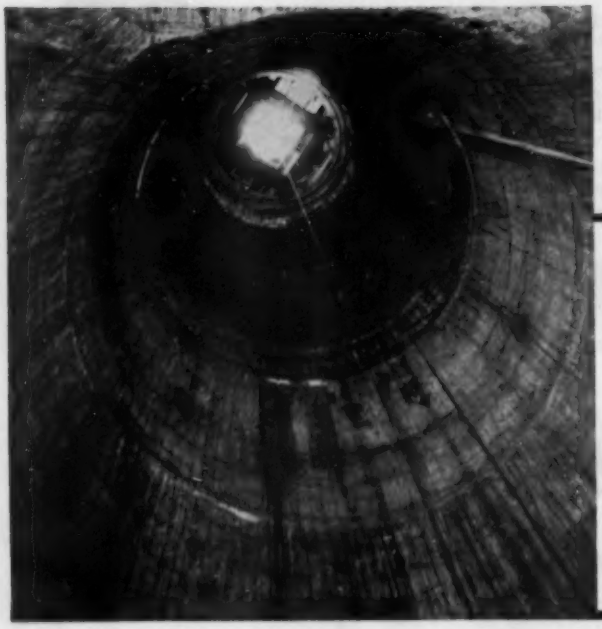
BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
WASHINGTON, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

Circle 531 on Reply Card for more data

How a hot problem in steel stacks was solved with refractory concrete



YOU'RE LOOKING UP one of the twin 215′ steel stacks lined with refractory concrete at Basic Refractories, Inc.'s plant in Maple Grove, Ohio, for dead-burning granular refractories Smooth, jointless construction and insulating properties provided excellent natural draft. Such refractory linings assure structural strength, plus high resistance to heat and corrosion.

REFRACTORY concrete linings in stacks, breechings and ducts provide protection against heat, corrosion and the abrasive action of high-velocity gases and fly ash. Made with suitable aggregate and Lumnite* calcium-aluminate cement, they withstand temperatures to 2600° F., and are highly resistant to thermal shock. Smooth, jointless construction allows excellent draft in stacks, breechings and ducts.

Stack linings are just one of the many ways special concretes made with Lumnite are serving industrial plants. They are readily poured, plastered or "shot" in place by cement gun. There are no small units to work loose; maintenance is lessened. When necessary, repairs can be made quickly, easily and economically. Refractory concrete made with Lumnite Cement reaches service strength within 24 hours.

• • •

FOR CONVENIENCE, many prefer to make refractory concrete with prepared castables. (Lumnite Cement plus suitable aggregates selected for specific temperature and insulation service—add only water.) They're made by refractory manufacturers and sold through their dealers. For more information, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

SPECIFIED TO MEET TOUGH DESIGN requirements, these stacks for large rotary kilns needed linings that could withstand 1400° to 1700° F. operating temperatures. Designers used an 8″-thick refractory concrete lining . . . poured in place.

**"LUMNITE" is the registered trade-mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

IP-L-69

ATLAS® LUMNITE for INDUSTRIAL CONCRETES

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station.

Circle 532 on Reply Card for more data

NONPAREIL
TRADE MARK
Turbine Oil

Nothing succeeds like service!

● This turbine, one of the largest industrial units in the Midwest, was recently installed by a leading paper mill. The decision of mill officials to lubricate the new turbine with NONPAREIL Turbine Oil was based on their own experience with this outstanding product.

Beginning in 1941 in one unit, NONPAREIL has since been put into additional turbines; and, today, it lubricates all turbines in this big mill. Over the period of 12 years, it has not been necessary to replace any of the original fills of NONPAREIL because of lubricant deterioration or lubrication trouble. Oil systems have stayed clean. Oil acidity has stayed below 0.07 mg. KOH/gm.

In this mill, as in power plants throughout the Midwest, NONPAREIL has sold itself into one turbine after another. That success has been the result of superior turbine lubrication service. Service records of NONPAREIL cover up to 25 years' continuous operation of individual units on original fills of oil. Moreover, this unique lubricant carries a written guarantee that it will last as long as the turbine it lubricates and that its neutralization number will stay below 0.15 mg. KOH/gm.

The Standard Oil lubrication specialist serving your section of the Midwest will be glad to show you lubrication records of NONPAREIL in installations similar to your own. You can contact this specialist by phoning your local Standard Oil office. Or, write: Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago 80, Illinois.

STANDARD OIL COMPANY STANDARD *(Indiana)*

Circle 533 on Reply Card for more data

Maybe you're not from Missouri...

but let BELL & ZOLLER show you why

Superwashed coals are the best!

You will discover that Bell & Zoller's *Superwashed* coals are super-clean, high-heat producing, and correctly processed for your burning equipment to keep boiler efficiency up . . . steam costs down. Shipped economically via rail or rail-water routes from Kentucky, West Virginia, Indiana or Illinois. You'll be completely satisfied. We stake our reputation on it!

COAL HEATING SERVICE

BELL & ZOLLER COAL COMPANY

BELL BUILDING, CHICAGO 1, ILLINOIS

ST. LOUIS · LOUISVILLE · OMAHA · MINNEAPOLIS · TERRE HAUTE · MILWAUKEE

Sixty-Eight Years of Service to Coal Users

Producers of
ZEIGLER, MOSS HILL, ORIOLE, MURDOCK, and BUCKHORN Coals

Sales Agents for

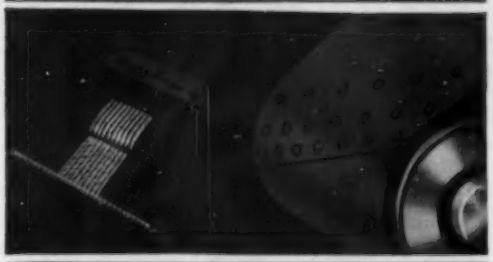
Otter-Creek-Eagle Coal Co.
Lockwood, West Virginia

Spring Hill Mining Company
Terre Haute, Indiana

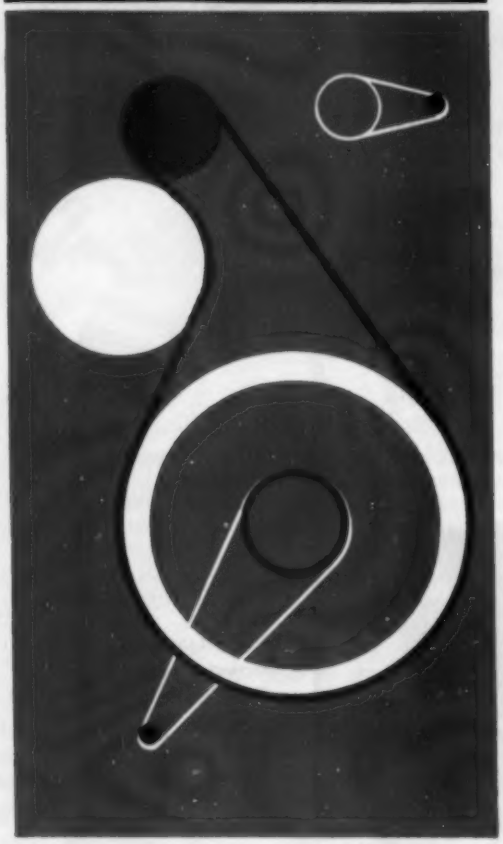
Boone County Coal Corporation
Sharples, West Virginia

Circle 534 on Reply Card for more data

you get "more use per dollar" two ways . . .



with CONDOR WHIPCORD BELTS



These endless belts are cost-savers on all endless drives, but they prove their extra quality on "belt-killer" drives—short centers, small pulleys, reverse bends, high speed and high tension.

Condor Whipcord Belts are practically unaffected by variations in atmosphere—no shrinkage —no stretch—no downtime for take-up.

Extensible-Tip cover-end splice with rubber rivets (shown above) eliminates cover separation, gives belt much longer life—outlasts 2 or 3 ordinary types of endless belts on many drives.

You get "More Use per Dollar" two ways . . . more dependable machine operation . . . longer endless belt life.

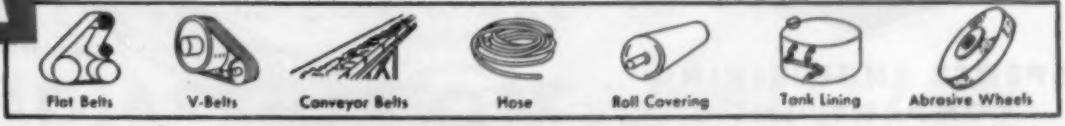
Ask the R/M Distributor for Bulletin 6869.

He also can tell you how to get "More Use per Dollar" with R/M hose, V-belts and conveyor belts.

R M

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Bowling Balls

Circle 535 on Reply Card for more data

Guaranteed TO SHUT TIGHT*

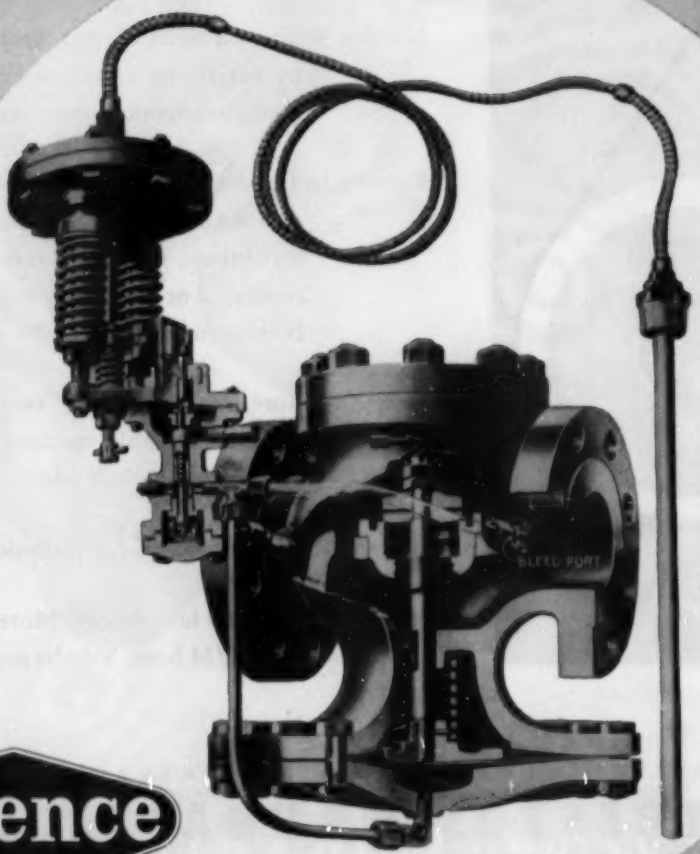
*When equipped with a SECO Metal Seat and Disc on steam service and protected by an approved Strainer, a Spence Regulator is guaranteed to shut tight when the demand for steam ceases.

Expensive steam leaks due to a lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Here is why we can make such a guarantee:

First, our temperature regulators are of the single seat design. Seats and discs are made of durable SECO Metal. More than 20 years experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.



SPENCE
TYPE ET150
Temperature
Regulator

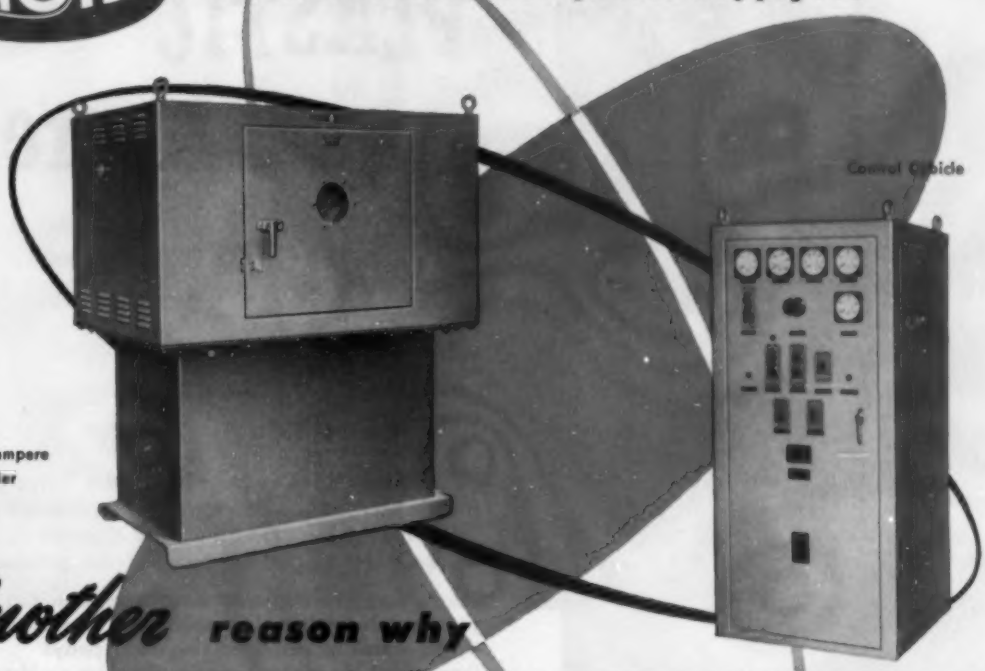
Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Circle 536 on Reply Card for more data

AEROTEC

electronic Kenotron power supply...



Another reason why

AEROTEC ELECTRICAL PRECIPITATORS

require less maintenance

Aerotec Electrical Precipitators provide long uninterrupted service and require *minimum maintenance*. One reason for this is the exclusive electronic power supply developed for Aerotec Electrical Precipitators which provide these advantages:

1. Complete package unit eliminates field installation problems, cage enclosures and ventilating systems.
2. Control cubicle may be placed on boiler operating floor while rectifier is mounted adjacent to the precipitator.
3. Instantaneous overload protection safeguards Kenotron tubes assuring long life.
4. Electronic power supply eliminates noise, noxious and toxic gases commonly associated with mechanical types.
5. No moving parts; nothing to wear, nothing to lubricate.
6. Rugged constant current network control eliminates operator attention.
7. Rectifier available in weatherproof cubicle for outdoor installation.

In addition to more efficient power supply, Aerotec Electrical Precipitators offer higher collection efficiency by:

- Pocket-type collecting electrodes that prevent dust reentrainment.
- Exclusive high voltage flat plate provides a field of uniform high intensity for maximum precipitation.
- Electromagnetic rappers of low intensity impact clear electrodes of deposit on a continuous short interval basis.

For additional data on Aerotec Electrical Precipitators write or call our project engineers—

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 38 Principal Cities)

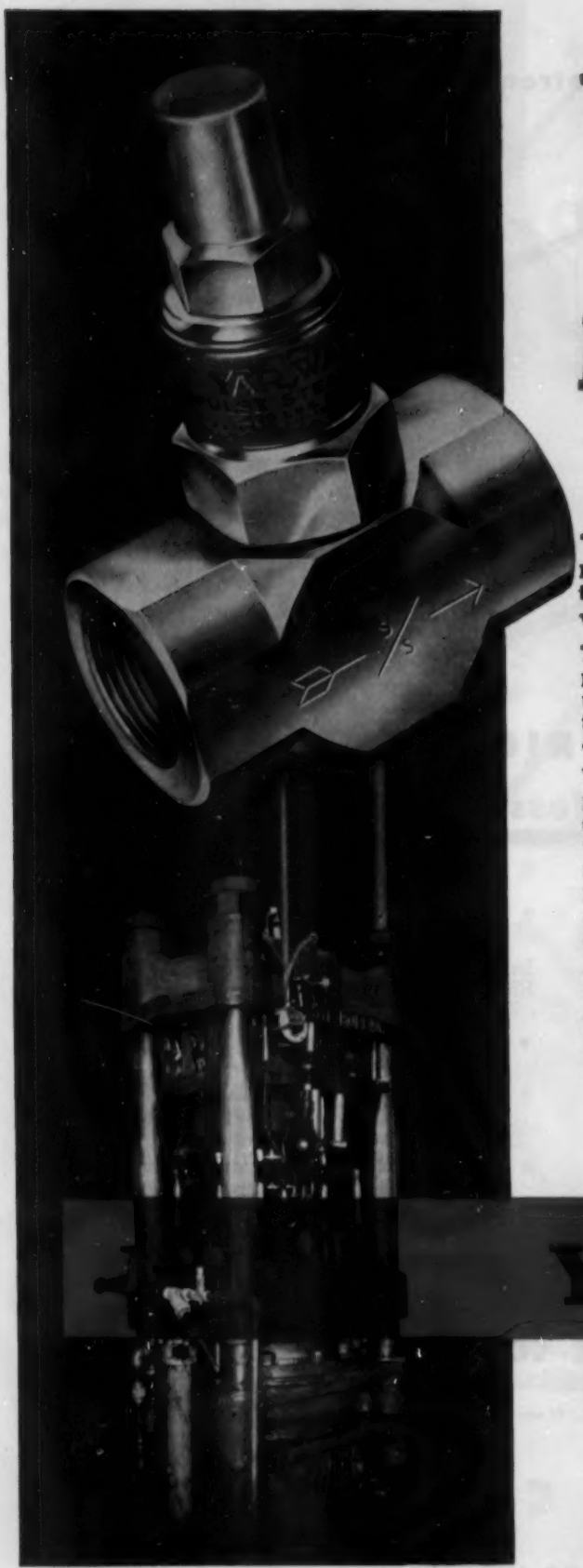
Canadian Affiliates: **T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario**

Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.

Circle 537 on Reply Card for more data



PLASTIC goes to press FASTER

"The use of Yarway Impulse Steam Traps on our platen presses has speeded up our production rates to such an extent that it almost appears we have developed an entirely new process."

That's the Chief Engineer of a large Michigan plastics fabricating plant speaking . . . and he backs up his words by standardizing on Yarways throughout the plant three months after making a trial installation.

You may be surprised at how much faster your product can be produced when Yarways trap your steam equipment. Yarway Impulse traps are designed with production in mind. They insure sending maximum B.T.U.'s at top temperature into your process or product. They get equipment hotter, *sooner* . . . and keep it hot!

Yarway Impulse traps are small, easily installed, good for all pressures, made of stainless steel, require minimum maintenance, cost little.

Try Yarway Impulse traps yourself. Stocked and *sold* by 216 Industrial Distributors. For steam trap advice, call your nearby Yarway trap engineer.

YARWAY

the steam trap
designed with more production in mind

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.

Circle 538 on Reply Card for more data

Note clean exhaust with oxidizing catalyst.

Industry and I&P Power

Oxidizing Catalyst

. . . A solution to air pollution problems

WILLIAM M. BOWEN, Chief Engineer
Oxy-Catalyst, Inc.

OXIDIZING CATALYST developments now seem to offer a positive answer to many plant pollution problems. Invented by Eugene J. Houdry, pioneer in the catalytic cracking of petroleum, the Oxycat, after a year's study of its use in various industrial installations, has shown that it can:

¶ Remove odors and visible smoke from stacks exhausting unburnt materials, including carbon monoxide gases.

¶ Generate usable heat in the process—enough to cut the plant fuel bill of one user by 90 percent;

¶ Turn waste gases into usable power — in one instance enough to run a gas turbine;

¶ Indirectly improve production processes and products and increase safety by reducing fire hazards.

RCA Oven Installation

At the Radio Corporation of America, the Oxycat ended a localized but intense in-plant pollution problem. Plagued by an irritating wax smoke that blew into the company's eight-story engineering office building from a nearby exhaust stack, the company installed a bed of the new Oxycats to oxidize the smoke at its source—a burn-off oven in RCA's powdered metals division.

In making powdered metal parts, RCA uses a wax binder to hold the parts together before final pressing. But after pressure molding and before the parts can be sintered, the wax binder must be driven off. In doing this in a burn-off oven, RCA had been driving out to the air a mixture of wax particles and vapor —a smoke with an odor of burnt cork—very annoying to breathe.

Selecting Method

The company first considered various methods of eliminating the wax smoke. The exhaust could be collected, condensed, filtered, or burned. It was decided that some method of burning would give the most positive results with a minimum of maintenance and operating headaches.

Burning, in the ordinary sense of direct ignition of the fumes, would have been costly. A large volume of fume-air mixture (1400 cubic feet per minute) would have to be brought up to an ignition temperature of 2000 F or more. This, in turn, would require a high fuel consumption, a large combustion chamber, and elaborate insulation and stack construction to withstand high temperatures.

RCA turned to catalytic oxidation —a method for burning the wax smoke at temperatures well below the normal ignition point. The company installed a bed of 204 Oxycats above its burn-off oven.

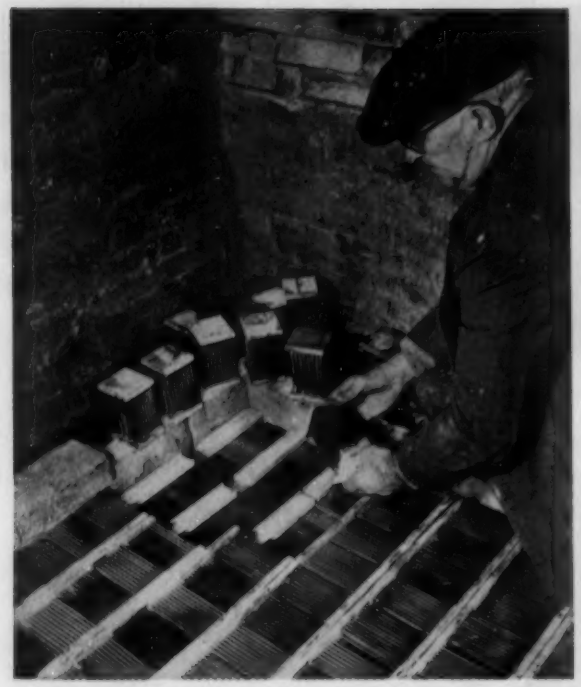
Each Oxycat unit is a cage-like structure of 73 porcelain rods held together by two square porcelain end-plates and a porcelain spacer bar. The surfaces of these rods—tear-drop shaped to minimize back pressure—are coated with the catalytic agent—alumina and platinum alloy in this case.

The Oxycats are stacked side-by-side and one on top of the other in the exhaust stack of the oven. The waste gases flow across the Oxycat rods. At the coated surfaces of these rods a catalytic reaction takes place, oxidizing the exhaust to a harmless effluent of carbon dioxide and water vapor, invisible to the eye.

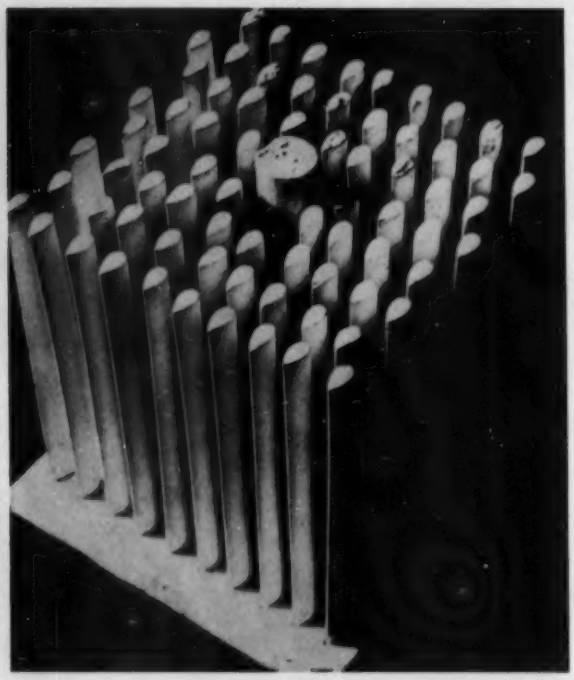
Results

The oxidizing temperature of the Oxycat is 500-550 F. Since the wax fumes leave the burn-off oven at about 300 degrees, RCA installed a pre-heat burner to raise temperature to the desired point. The catalyst in turn raises exhaust temperatures another 50-100 degrees—a relatively small increase due to the low concentration of the contaminants. Operation to date has shown complete elimination of the wax smoke.

The catalyst also eliminated pockets of fumes which previously had a tendency to collect above the oven. At the same time the slow build-up of wax deposits in the oven stack was stopped. This build-up would obstruct air movement through the oven, gradually changing oven conditions and prevent maintaining



A workman at Enamelstrip Corp. puts the finishing touches on a bed of Oxycats to oxidize solvent fumes.



Removal of one of the end plates of oxidizing catalytic unit reveals tear-drop cross section of the rods.

consistently high quality production.

RCA has mounted both the preheat chamber and catalyst housing above the burn-off oven on a steel platform nine feet above the floor. The compact installation minimizes the travel distance of the wax fumes and prevents the accumulation of wax in the ductwork.

Profitable Heat Recovery

The Oxycat installation at the enameling plant of Enamelstrip Corp., Allentown, Pa., has curbed a serious community air pollution problem for Enamelstrip and at the same time has generated enough usable heat energy to cut plant fuel bills by 90 percent.

Enamelstrip runs four metal coating lines—processes in which enamel and lacquer coatings are rolled onto continuous metal coil, then baked dry in an oven. These ovens had been driving off as many as 30 drums of xylene and tolul solvents a day into the neighboring community. The company's public relations problem with the neighbors was an acute one!

Because the oven exhaust is sometimes below 500 F (the oxidizing temperature of the Oxycat) a preheat burner has been installed to raise stream temperature at the start of a production run if necessary. The hot solvent fumes next strike the catalyst bed (814 Oxycats) and are immediately oxidized to a harmless vapor or gas.

Stack temperatures above the catalyst then rise to as high as 1400 F. The preheat burner is automatically shut off as there are enough combustibles in the gases to make the catalyst bed self-sustaining. The main gas burners are also shut off since Enamelstrip can then recirculate catalyst heat to run its ovens.

The plant has enough heat left over to supply other processes and, when steam coils are installed over the catalyst bed, will have enough energy for general plant heating needs. Even then the company will be throwing a high percentage of its catalyst heat away.

Enamelstrip has also been able to increase production. Before, the company had been operating its ovens to the full capacity of the burners. With unlimited catalyst heat, it has now doubled coating speeds and plans to double them again in the near future.

Power Generation Too

Sun Oil Co. reports that pollution control was not the problem when it installed $25,000 worth of catalyst to consume waste cat cracker gasees. The objective was heat recovery and power generation.

Sun Oil uses a different Houdry catalyst—in pellet form—to crack crude oil into high-octane gasoline at its Marcus Hook, Pa. refinery. During each cracking cycle, the catalyst pellets become coated with coke and tarry products.

Usable Heat

In regenerating the petroleum catalyst (burning off this coke with hot air) a large volume of waste gases (carbon-monoxide and hydrocarbons) is developed. Sun Oil now runs these gases through an Oxycat bed and generates 7,500,000 Btu per hour of usable energy.

Most of this heat is picked up in molten salt pickup tubes in the Oxycat chamber. The heat is used to generate process steam. The remainder of the energy in the gases is fed to a gas turbine that powers an air compressor.

With the Oxycat installation complete on only one-half of this particular cracking plant, Sun Oil is already recovering $27,500 worth of previously wasted energy. When installation is completed on this unit, savings should jump to $80,000. Refinery-wide savings when all Sun Oil crackers are catalyst-equipped are expected to reach $500,000 a year at the minimum.

Other Uses

Still another use for the Oxycat is the removal of coffee odors. An in-

stallation on the rooftop of the coffee-roasting plant of Eppens, Smith Co., Inc., New York, has shown that the catalyst can completely end the coffee odor problem.

The Houdry catalyst has also shown that it can reform smoky incinerators, completely removing visible smoke, odors, and organic particles. In its first use in incinerators in Huntington Park, Calif., the catalyst put back into action an incinerator labeled "Smokey Joe"—that had been shut down for its smoking habits.

A major use for the Houdry catalyst—in fact its first use—is in a catalytic muffler for control of industrial truck exhausts. A typical user, Land o' Lakes Creameries, Inc., reports that it uses four such catalytic mufflers to permit mechanization of handling operations in its basement storage area—a confined, unventilated room 90 by 120 ft with a nine-foot ceiling.

When Land o' Lakes first tried to run a gas-powered truck in this area, the fumes proved too much for the operator. The company now operates four catalyst-equipped trucks in the same area with no harmful effects. As in industrial installations, the catalytic muffler burns the noxious engine fumes to harmless carbon dioxide and water vapor.

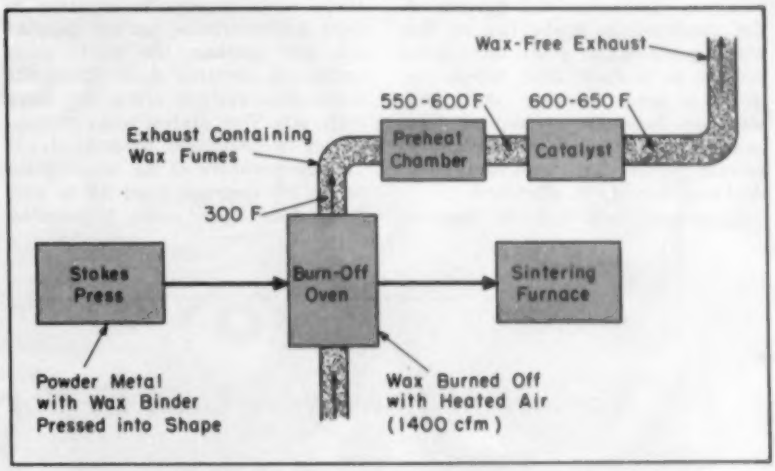
At present, the OCM Catalytic Exhaust, as it is called, is being factory installed by many fork truck makers and is offered as optional accessory equipment by some dealers.

Conditions of Operation

The basic chemistry of the Oxycat indicates a wide range of uses. The Oxycat will burn almost any vapor or gas that can be oxidized—and do it at temperatures that are lower and hence less costly than other methods such as flame incineration.

In actual practice, the Houdry catalyst works best on fumes that can be oxidized to either CO_2 or H_2O or both. That includes the entire family of hydrocarbons as well as carbon monoxide—prime industrial causes of air contamination.

The Oxycat will function successfully over a wide range of inlet temperatures and concentrations—from gas streams near the explosive limit to those with extremely minute concentrations of contaminants. Inlet temperatures—the temperature of the gases entering the catalyst—can range from room temperature or less up to 1500 F or more. In some cases, depending upon the actual inlet temperature and the concentration of the pollutants, pre-heating of the gases may be necessary.



A bed of 204 Oxycats at the RCA installation completely and efficiently burns the wax smoke at temperatures well below the normal ignition point.

¶ If the gases are above 500 F (the oxidizing point of the catalyst) and are rich in combustibles, probably no pre-heat will be needed.

¶ If the gases are rich in combustibles but below 500 F some pre-heat will be needed at start-up only.

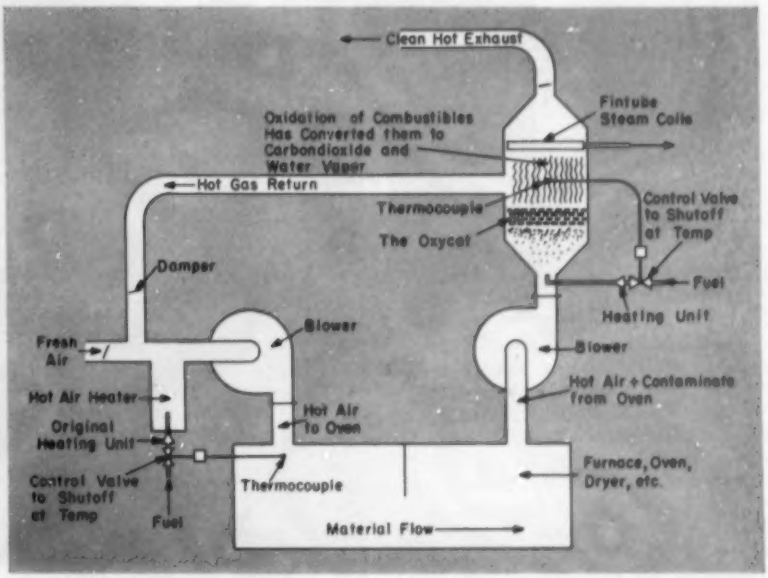
¶ If concentration of combustibles is not high enough to maintain catalyst temperature above 500 F, continuous pre-heat will be needed.

All such factors of design must be determined by competent engineering analysis. In general, the catalyst will raise stack temperature 55 F for every Btu per cubic foot of dry exhaust gas passing over the bed.

Prospect of Unlimited Life

As yet, no definite limit has been set to the useful life of the Oxycat. Under most stack conditions it is expected that the catalyst will last for many years.

The basis for this conclusion is a test recently conducted on catalysts initially installed at the Sun Oil Co. Marcus Hook refinery over a year ago. Tests showed that after 8500 hours of continuous operation, these



Flow diagram of a general catalytic application shows the control of air pollution and the recovery of waste heat released by exothermic reaction.

catalysts eliminated 99.2 percent of the combustible material in the waste gases—exactly the same percentage as in June 1952, when the catalytic heat recovery unit first went on duty. These results were most significant, since all previously known combustion catalysts have declined steadily in efficiency.

Operating conditions at Marcus Hook were severe. In addition to light hydrocarbons, carbon monoxide, and sulphur, the waste gases contained abrasive dust (from the petroleum catalyst) and heavy tarry materials. The catalyst was also subjected to continued thermal shock. The temperature of the waste gases jumps 500 degrees, from 800 to 1300 F and back again, every 10 minutes.

The findings at the Sun Oil Co. were later corroborated by the Research Institute of Temple University, Philadelphia, which tested the original Oxycats installed at the Enamelstrip Corp. Temple scientists reported that after 18 months of operation those catalysts were still eliminating 99.6 percent or more of solvent pollutants.

Variety of Conveyors Used In Making Insulation

VARIETY IN FUNCTION AND DESIGN are the highlights of the materials handling system at the Ehret Magnesia Manufacturing Co., Valley Forge, Pennsylvania. This plant, designed and constructed by The Kuljian Corp. of Philadelphia, is a leading producer of precision molded insulation products.

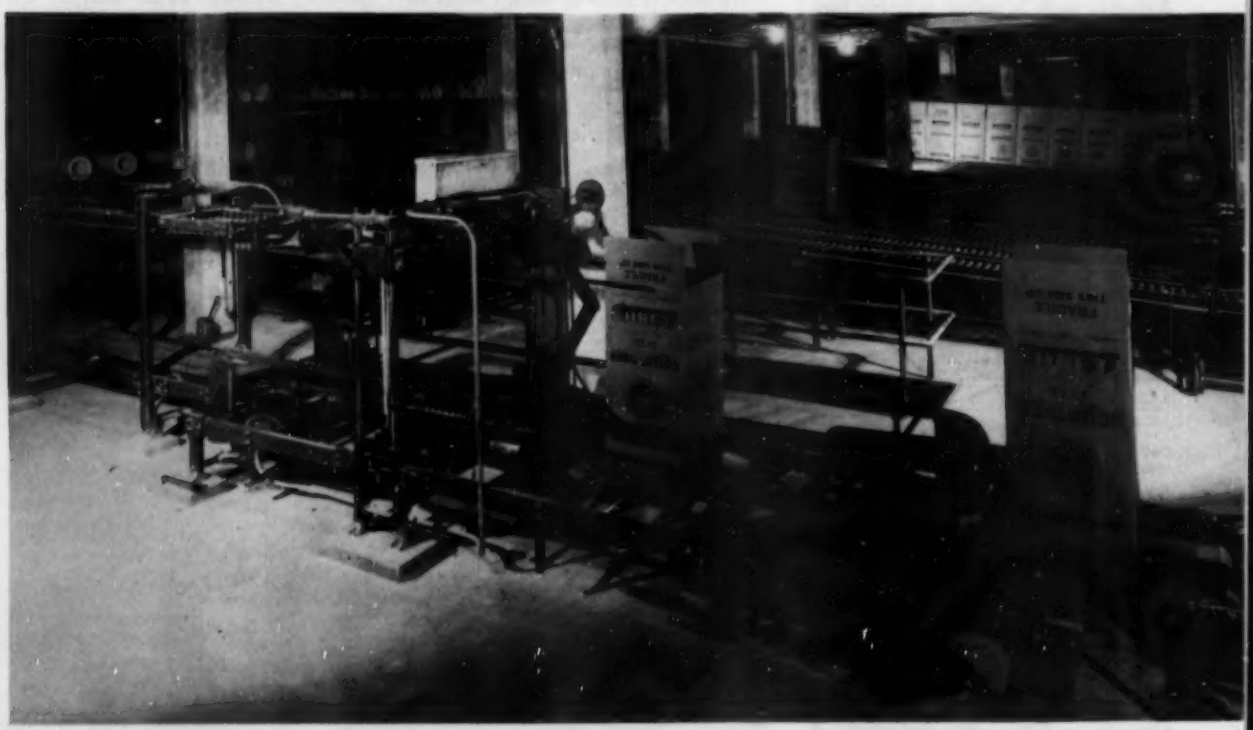
Bulk raw materials are placed on pallets and brought by an elevator to the processing areas. They are then fed pneumatically and by conveyor belt to the initial process equipment. A screw conveyor feeds the pre-mixed ingredients to a tilting rotary mixer which discharges into a traveling weigh larry.

The weigh larry is essentially a robot crane which positions itself over the batch heaters that supply the precision molding machines.

The wet product, having been hardened and formed in the molds, is hydraulically ejected and manually loaded on oven cars, which are transported to the dryers on a motorized transfer car. The oven cars are mechanically moved through the dryers by a conveying system which is synchronized with oven door operation.

The dry product is manually unloaded from the cars onto an apron conveyor which passes the material through trimming and slitting saws, and then to the jacketing, and packaging operations.

Finished and packaged material is accumulated on a series of gravity roll conveyors and transported directly to the shipping department.



The finished goods production of two shifts is accumulated on this series of gravity roll conveyors. When the shipping department resumes operations (day shift), the material is fed from the storage conveyors to live roll conveyors.

Measurements being made in the field to check the radiation at prescribed distances from equipment.

Eliminating RF-Heating Interference

How interference from induction and dielectric equipment can be licked — based on experience from living with the FCC's new regulations governing rf interference.

W. C. RUDD
Vice President
New Rochelle Tool Corporation

ANY PIECE of equipment that utilizes high-frequency electrical power may radiate some of its power to space as a radio transmitter does. This radiation may interfere with normal communications services; the Federal Communications Commission has issued, therefore, a set of regulations for the control of such conditions. Control is a relatively simple matter when certain fundamental rules are observed.

The FCC order states that industrial heating equipment using frequencies above 10 kc shall operate either in assigned frequency channels where the radiation may be unlimited or, if operating outside of an assigned frequency channel, the equipment shall be certified to have a radio-wave radiation level of less than 10 microvolts per meter at a distance of one mile from the installation. Specific frequency channel assignments exist at 13.56, 27.12, 40.58, and 2450 megacycles; each of these channels has its own allowable frequency variation.

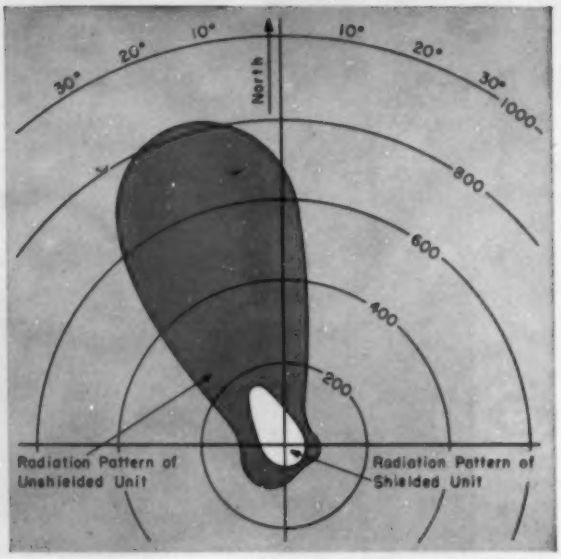
The FCC document also states that if interference occurs with any radio service, even though the equipment is operating within the rules and regulations, such interference must be corrected. Violation of the regulations will result in a notice that further operation is unlawful without a station license, and a court order may be issued demanding a shut down of the equipment.

Field Measurement

The certification of the equipment involves a number of radio field intensity measurements to be made in a specified manner in the area in which the equipment operates. The responsibility of having this certification done and having the required certificate available lies with the user of the equipment. Since nearly all of the installations already in use do not operate within the specified frequency channels, the part of the rules which is of primary interest is the certification of equipment lying outside of these assigned frequency bands.

In arranging for the certification of a piece of induction or di-electric heating equipment, a preliminary inspection should be made by some competent person to determine whether it will have a reasonable chance of passing the radiation requirements. Usually defects can be detected and easily corrected before the rather elaborate set of field intensity measurements is made.

After the equipment has been prepared for test (shielding placed in good order and a typical load connected to the equipment) a set of field intensity measurements is made with special instruments in a circle around the equipment at a distance of several hundred feet. The directions of maximum radiation are thus detected and further measurements are made along these radials to a distance of one mile. If the radiation is less than 10 microvolts per meter at the one-mile points, then a certificate may be issued by the inspecting engineer giving a short resume of the tests made and stating that the



Screen rooms (above) effectively shield radiation. Radiation fans out in a lobe from typical equipment (right); after shielding, the gray lobe is choked off and radiation is confined to the white lobe.

equipment falls within the allowable limits.

If there is a group of units within a radius of 500 feet, they may be certified as a group. In this case, all measurements are taken about a single selected center which considerably simplifies the measurement problem.

Radiators

Induction heating equipment generally operates at frequencies below 500 kc. At such frequencies appreciable radiation may exist only if the radiator (antenna) is relatively long, i. e., several yards. With dielectric heating equipment (generally operating above two megacycles) radiation may be severe because the length of the radiator required for appreciable radiation at these frequencies is considerably less, i. e., several inches. With a given set of conditions on a radiator, a high frequency will produce considerably more intense radiation than will a lower frequency. Thus the shielding problems on dielectric equipment are much more severe than on induction heating units.

Certification by Manufacturers

Certification of induction and dielectric heating equipment has been required for all units manufactured since July 1, 1947. Certification can be by the manufacturer. This is applicable to both induction and dielectric equipments where the customer will make practically no change in the operation of the equipment from the manner intended by the manufacturer. For example, in an induction heating unit which is built as a complete entity, the only change that the user normally makes is to change the work coil. With properly designed equipment this can be done without appreciably changing the radiation from the equipment.

In the case of dielectric equipments, a manufacturer's certification would be valid, for example, on a plastic preform heater in which the only changes made by the user would be in the spacing of the electrodes. Both kinds of units can be type-certified by the manufacturer and delivered to the user with certification based on proper installation of the equipment.

A second kind of certification would be that done at the location where the equipment is installed. Typical of this case would be a dielectric heating unit installed for the drying of glue in furniture manufacture in which the electrodes were constructed by the user. In this case the certification would have to be done after the equipment was completely installed and operating on the user's premises.

Equipment Frequencies

Prior to 1947, a fairly high percentage of induction heating installations used frequencies below 10 kc, and no certification of these is necessary. Into this category fall high-frequency motor generator sets and 1000 to 3000 cycle ignitron inverter units.

Vacuum tube induction heating units, built prior to 1947, would have to be certified since they generally operate in the frequency range from 100 to 500 kc. Most of the vacuum tube units have a metal cabinet; if such is the case, there is ordinarily no great problem in certifying the unit. However, if there is a nonmetallic case, then it may be necessary to provide additional shielding.

Spark gap equipment may be divided into two types—the quenched gap and the mercury-hydrogen gap. Most of the quenched gap units built prior to July 1, 1947 either have a wood or a transite cabinet and operate in a frequency range from 200 to 500 kc. Therefore, it may be necessary to provide additional shielding in order to pass the FCC requirements.

Most of the mercury-hydrogen gap units operate in the frequency range from 20 to 70 kc and are built with a steel case. There should be little difficulty in meeting the FCC requirements with such a low frequency and with the shielding of a metallic case.

Dielectrics' Frequencies

Dielectric heating equipments built prior to July 1, 1947, may not meet the requirements easily, since they ordinarily operate at frequencies above two megacycles. In many cases they use electrodes without any shielding whatsoever.

Plastic sealing units generally operate in a frequency range from 6 to 160 megacycles and very seldom use any shielding over the electrode system. Appreciable radiation may occur from the electrode as well as from the unit's oscillator itself. Equipment of this type with open electrodes normally has no chance of meeting the requirements without corrective measures.

Next are the plastic preform di-

electric heaters normally operating in a frequency range from 6 to 50 megacycles and usually having a small electrode assembly. In many cases, the electrode system is mounted in a shielded enclosure. With a reasonably well designed oscillator cabinet and electrode housing, no problem in certification should exist. However, if the electrodes are not shielded at all, or are only partially shielded, there will be little chance of meeting the requirements without corrective measures.

Third, there are the dielectric units for curing glue and rubber and for heating other chemical compounds; they generally operate in a frequency range from 2 to 50 megacycles. Normally some degree of shielding has been provided by the manufacturers. Such units can not be expected to meet the FCC requirements without proper shielding methods.

Foundry core baking is of comparatively recent origin; the first production units were constructed in 1947. Since they are the type of unit which is a complete entity, they are probably already type-certified by the manufacturer.

Interference Within Rules

One of the stipulations of the FCC is that, if interference is caused, the condition must be corrected even though the equipment is operating within the rules. This can become a severe problem, particularly in the case of interference with radio receivers or television units in the immediate vicinity of the rf heating installation.

The amount of interference caused to either radio or television sets is a function of the intelligence signal level being received. If the set is operating in a fringe area, i.e., with a very low signal level from the transmitting station, then the ratio of intelligence signal intensity to interfering signal intensity may be such as to cause a problem. The solution to this has been extreme shielding of the heating equipment, or installation of wave traps, special antennas and other devices on the radio or television set. Protecting the receivers is often most economical.

Readying Equipment

If preliminary examination of the equipment shows that it has little chance of meeting the rules, then it would be a waste of time to make a set of field intensity measurements. The equipment first must be given a reasonable chance of success.

The initial course of action, though probably the least likely to be used, might be to convert the equipment so that its frequency is within one of the allocated frequency channels where any radiation level is allowable. This is not at all feasible in induction heating equipment, since normal operation is usually at a frequency considerably below any of the allocated channels.

In the case of dielectric heating units it is also normally not feasible to change frequencies because the dielectric characteristics of the load change so radically during the heating cycle with a fixed frequency, that a very complicated load-following and tuning mechanism would be required; this would usually cost many times the price of shielding.

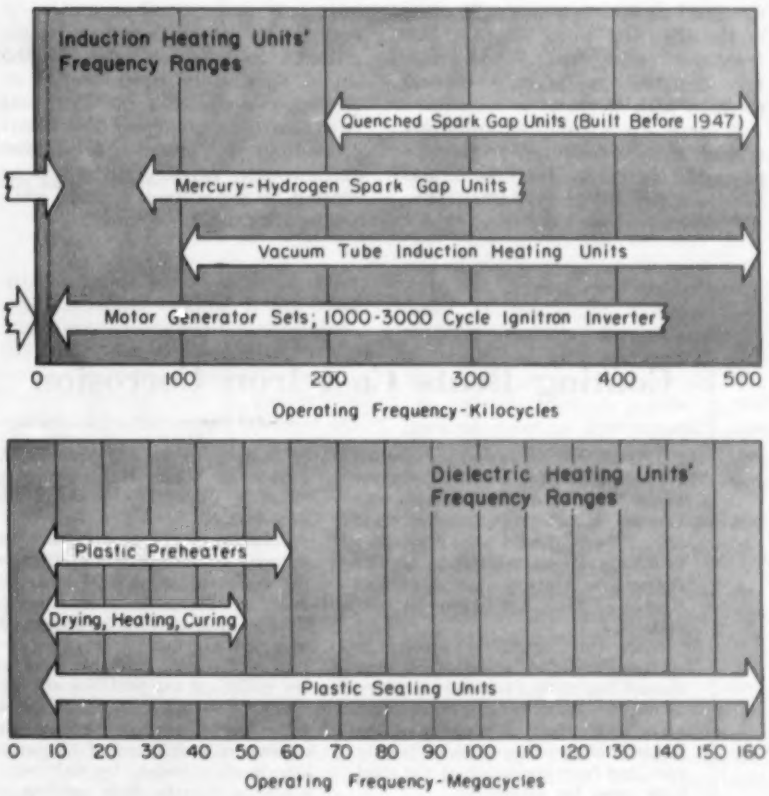
Equipment Height

Radiation from equipment, regardless of frequency, is a function of the height of the unit above the earth's surface. Therefore, the radiation at one mile from a piece of equipment on the eighth story of a building might be considerably above the allowable intensities; if this same piece of equipment were installed on the ground floor, the radiation might be well below the maximum allowable. An obvious trick, therefore, is to install the equipment as low as possible.

Shielding

The usual method of making a piece of equipment meet the FCC rules is to use shielding of one form or another. A shield is an electrical conducting (metallic) barrier to the passage of radio fields. In some cases it will only be necessary to improve the existing shielding. The unit may be completely enclosed in a metal cabinet, but there may be some ventilation openings or doors which permit radiation to escape. This case can be corrected by installing wire mesh shielding over the ventilation openings and by placing proper electrical contacting or overlapping surfaces on the doors and door jambs.

If new shielding is required, a number of materials and methods are available. Either copper or bronze wire mesh may be used as a



Frequency ranges of induction (upper) and dielectric (lower) units vary; higher frequencies are emitted best by smaller radiators on equipment.

housing; a sheet metal enclosure of copper, aluminum, or steel may be used. It may be necessary to go so far as to install a double shield, with one housing inside of the other. This is normally not necessary except where adjacent sensitive laboratory instruments or other electrically delicate devices are being affected by the radiation.

Guard Openings

All access doors and other openings in the shielded structure have to be of a special design and construction. Usually doors are arranged so that when closed they make electrical contact all around their periphery. They can also be arranged with sufficient properly designed overlap around the sides so that no radiation leaks occur. In place of a hinged door, a right-angle shielded passageway may be used, allowing freer access to the room.

It may be necessary to have a radiation barrier where no door or covering can be used. A case in point is a conveyor continuously carrying materials between a pair of dielectric heating electrodes. Here, an electrical labyrinth is used; the conveyor passes through a metallic throat whose length and area are designed so that they are a function of the electrical wave length of the frequency being used. When properly designed, radiation is choked off to a high degree.

If there are a group of units operating closely together, it may be advisable to consolidate them and build a single shield over the group.

Radiation from induction or dielectric equipments may not come directly from the equipment but may be the result of feedback of radio-frequency energy into the power lines connected to the unit. It is possible for the power line itself to act as an antenna, the radiation taking place at some distance away from the radiation source.

The correction of feedback is relatively simple. The installation of a filter in series with the power line will block the return of any radio frequency energy to the incoming power line. It is, of course, necessary that the filter carry the low frequency power line feed to the equipment with as little loss as possible. Standard filters for frequency blocking are available.

Where a shield has been installed on equipment and a filter is also to be installed, great care must be taken to see that the filter is installed at the proper point in the shield; otherwise it may be completely ineffective.

Grounding

Many misconceptions have grown regarding the necessity of grounding such equipment and shields in order to reduce radiation. It is usually of considerable advantage to have only one ground on a piece of equipment, rather than five or six grounds to various parts of the shield. Where the equipment is on the upper floors of a building, less radiation is produced without grounding. It is essential to prevent extraneous circulating current loops created by superfluous ground connections or ties.

A shield may be satisfactory on the day that it is tested for radiation and certified, but it will continually deteriorate. Joints corrode, screws come loose, seams open, insulation absorbs moisture; all of this tends to increase the radiation from the unit. Therefore, it is essential that shields be periodically inspected for breaks, corroded joints, loosened screws, poorly contacting or mating doors, and broken ground connections.

Checking Device

A relatively simple device for checking the condition of a shield is described in the AIEE publication "Recommended Practices for Minimization of Interference from Radio Frequency Heating Equipment". The device is a probe which, if held near a loose joint in a shield or a suspected cable or door, will give a meter deflection showing that a radiation leak exists. Relative amounts of the leak can also be determined. This report also gives considerable information on the subject of radio interference.

Most of the problems mentioned above usually apply to older equipment. New equipment will normally meet the regulations easily and probably will be type certified by the manufacturer. Specific advice on the correction of radiation from troublesome installations may be obtained from equipment manufacturers or specialized consultants in the induction and dielectric heating field. The solution of radiation problems is usually not a complicated one and can be solved simply if care and intelligence are used.

Coating Beats Cast Iron Corrosion

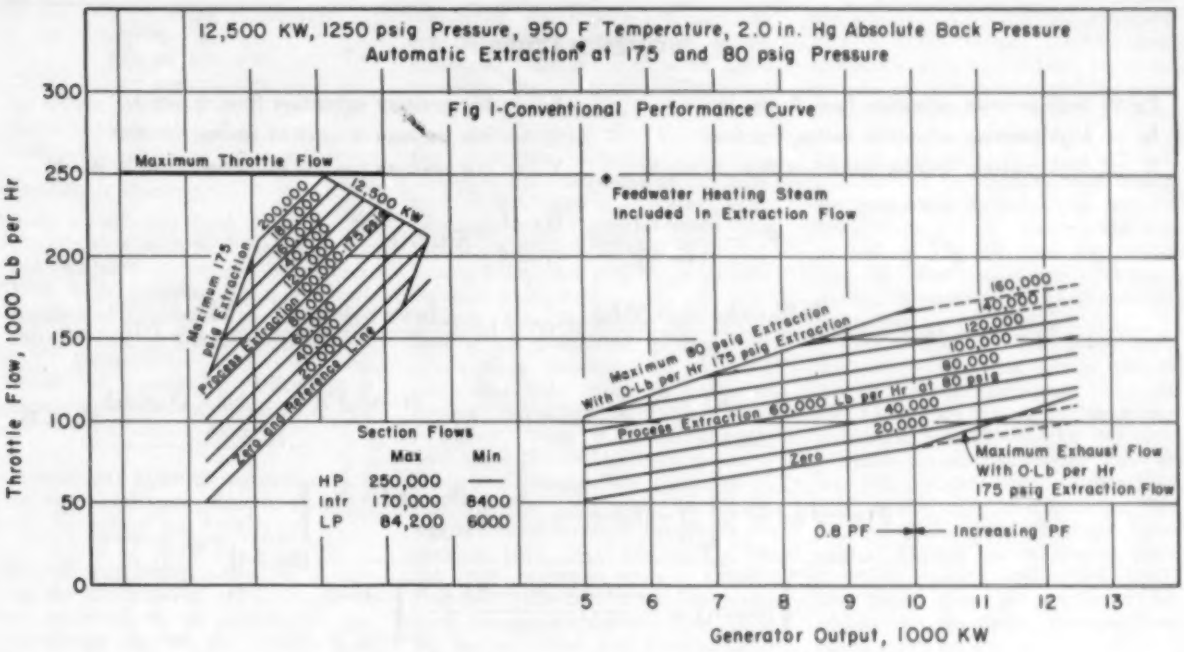
CORROSION of cast iron cooling equipment after two to three years in continuous contact with raw sea water at temperatures up to 225 F was found to present a problem, serious enough to require preventive measures at American Cyanamid Company's plant in Linden, N. J.

After this length of service in cooling sulfuric acid, there was enough loss of heat transfer efficiency to require more cooling equipment. Also, leaks were developing at the joints of the cooling sections largely resulting from corrosion of the steel bolts used for assembly.

Corrosion on the water side has been severe enough to build up heavy scale, which reduces the rate of heat exchange and promotes the growth of algae. Maintenance and cleaning operations tend to start new leaks.

Solution of the problem has been approached in two ways. First was the replacement of steel bolts with bolts of Navy bronze. American Cyanamid engineers in cooperation with those in the heat transfer division of National Radiator Company are reducing the problem still further by the introduction of a new-type coated cooling section. This coating is a mixture of 85 percent aluminum powder, by volume, in a plastic vehicle. It is applied immediately after the cast sections are removed from their molds. At this time, the surface has no trace of oxidation or scale.

The coated cooling sections have been placed alongside uncoated cooling sections for the cooling of acid from its highest temperature in both production units at the American Cyanamid plant. One bank of 64 coated sections, which has more than one year's service, shows practically no traces of corrosion or of algae. The contrast with the appearance of uncoated sections after the same exposure to this cooling water gives convincing evidence that longer service and more effective cooling will be obtained from them than from uncoated equipment. The reduction of surface scale and deposits of salt and algae is also expected to reduce cleaning.


12,500 KW, 1250 psig Pressure, 950 F Temperature, 2.0 in. Hg Absolute Back Pressure
Automatic Extraction at 175 and 80 psig Pressure
Fig 1-Conventional Performance Curve
Maximum Throttle Flow
Feedwater Heating Steam
Included in Extraction Flow
Throttle Flow, 1000 Lb per Hr
Generator Output, 1000 KW
Maximum 175 psig Extraction
Process Extraction 60,000 Lb per Hr at 175 psig
Zero and Reference Line
Maximum 80 psig Extraction
With 0-Lb per Hr 175 psig Extraction
Process Extraction 60,000 Lb per Hr at 80 psig
Zero
Maximum Exhaust Flow
With 0-Lb per Hr
175 psig Extraction Flow
0.8 PF
Increasing PF
Section Flows
Max Min
HP 250,000 —
Intr 170,000 8400
LP 84,200 6000

Automatic Double Extraction Turbines... Effect of Full Feedwater Heating

E. V. POLLARD, Section Engineer
Turbine Engineering Division, General Electric Co.

DOUBLE automatic extraction steam turbines should be designed to provide feedwater heating to the maximum temperature consistent with the top pressure level. Supplying steam for feedwater heating in addition to the process extraction will appreciably increase the throttle flow for a given load, but such procedure will decrease the plant fuel consumption as long as the flow to exhaust exceeds the minimum value.

With minimum flow to exhaust, full feedwater heating extraction would produce an increase of load above that generated by the process extraction flows. If this condition developed, load could be transferred from less efficient units. However, when no additional load is required at minimum flow to exhaust, the addition of feedwater heating extraction decreases the maximum simultaneous process extraction flows.

Since at any load the simultaneous process flows are much lower with feedwater heating, if the combined extractions show more potential load than the capacity of the turbine, a larger rating is indicated. The additional load is the output generated by the steam which is extracted to heat the feedwater. Thus, when process extraction flows do not develop sufficient load, the addition of feedwater heating extraction at the process pressures will decrease the flow to exhaust and provide fuel savings.

Double Automatic Extraction

Throttle flow with double automatic extraction is equal to the throttle flow with zero extraction, plus the high pressure extraction flow times the high pressure extraction factor, plus the low pressure extraction flow times the low pressure extraction factor. The conventional performance curve, Fig. 1, is constructed on this basis, using established data[1] plus the accompanying tables and charts.

Various limit lines are included on Fig. 1. When establishing these data, the maximum exhaust flow line is plotted on the lines of constant extraction flow at throttle flow equal to maximum exhaust flow plus the extraction flow. The maximum low pressure extraction with zero high pressure extraction flow line extends through points on the lines of constant low pressure extraction flow at throttle flow equal to low pressure extraction flow plus minimum flow to exhaust.

Usually, the zero extraction and reference line for high pressure extraction is drawn at a 45 degree slope. At any line of constant extraction, the increment is equal to high pressure extraction flow times high pressure extraction factor.

Maximum intermediate flow limits are developed on the lines of constant high prersure extraction flow at throttle flow equal to maximum intermediate flow plus high pressure extraction flow. The maximum high pressure extraction line is plotted on the high pressure extraction lines at throttle flow equal

NOMENCLATURE

F_H = high pressure extraction flow, lb per hr
f_H = high pressure extraction factor, fraction
X = high pressure process extraction flow, lb per hr
F_L = low pressure extraction flow, lb per hr
f_L = low pressure extraction factor, fraction
Y = low pressure process extraction flow, lb per hr

$$F_L = \frac{(F_o - F_e)}{(1 - f_L)} - F_H \frac{(1 - f_H)}{(1 - f_L)} \quad \text{(Eq. 2-1)}$$

$$F_T = F_o + (X \times f_H) + \frac{f_H (h_t - h_e) \times (X \times f_H)}{1025} + (Y \times f_L) + \frac{f_H (h_t - h_e) \times (Y \times f_L)}{1025} \quad \text{(Eq. 2-2)}$$

$$F_e = F_{CP} - X(1 - f_H) - \frac{(1 - f_H) \times (h_t - h_e) \times (X \times f_H)}{1025} - Y(1 - f_L) - \frac{(1 - f_H) \times (h_t - h_e) \times (Y \times f_L)}{1025} \quad \text{(Eq. 2-3)}$$

$$Y = \frac{(F_{CP} - F_{CM}) - X\left[(1 - f_H) + \dfrac{(1 - f_H) \times (h_t - h_e) \times f_H}{1025}\right]}{\left[(1 - f_L) + \dfrac{(1 - f_H) \times (h_t - h_e) \times f_L}{1025}\right]} \quad \text{(Eq. 2-4)}$$

$$\frac{\text{Maximum Intermediate Flow}}{1 - \text{Heat Rise}/960} + \frac{\text{HP Process Flow}}{1 - \text{Heat Rise}/960} \quad \text{(Eq. 2-5)}$$

Designations and formulas are in addition to or a revision of previous definitions[1].

EXAMPLE FOR 12,500 KW DOUBLE AUTOMATIC EXTRACTION STEAM TURBINE

1250 psig pressure *950 deg F temperature* *2 in. Hg absolute back pressure*

Automatic extraction at 175 psig and 80 psig pressure

TSR_1 = 5.945 lb per kwh TSR_2 = 15.19 lb per kwh TSR_3 = 11.95 lb per kwh

With three stages of feedwater heating, the two upper stages from automatic extraction lines and the lower stage a deaerating heater.

The following values are calculated using established data[1] and the accompanying information.

Zero double automatic flow or steam rate factor at 80 percent load = 1.025

Load, percent	*Zero extraction flow factor*
40	0.62
60	0.81
80	1.00
100	1.19

Zero Extraction Operation

Load, kw	*Flow, lb per hr*		*Steam Rate, lb per kwh*
10,000	5.945 × 10,000 × 1.025/0.698 × 1.020 × 1.000 =	84,200	8.42
7500	84,200 × 0.81 =	68,200	9.09
5000	84,200 × 0.62 =	52,200	10.44
12,500	84,200 × 1.19 =	100,200	8.02

TSR_1/TSR_2 = 5.945/15.19 = 0.391 f_H = 0.630 $1 - f_H$ = 0.370
TSR_1/TSR_3 = 5.945/11.95 = 0.498 f_L = 0.523 $1 - f_L$ = 0.477
$1 - f_H/1 - f_L$ = 0.776 Minimum flow to exhaust = 6000 lb per hr

Plot Fig. 1 from above data according to method outlined in the text.

Data for Fig. 2A

Load	5000	5000	7500	7500	10,000	10,000	12,500	12,500
F_o	52,200	52,200	68,200	68,200	84,200	84,200	100,200**	100,200**
F_e	6000	6000	6000	6000	6000	6000	6000	6000
$F_o - F_e$	46,200	46,200	62,200	62,200	78,200	78,200	94,200	94,200
$F_o - F_e/0.477$	96,900	96,900	130,400	130,400	164,000	164,000	197,500	197,500
F_H	50,000	100,000	50,000	100,000	100,000	200,000	100,000	200,000
$F_H \times 0.776$	38,800	77,600	38,800	77,600	77,600	155,200	77,600	155,200
F_L	58,100	19,300	91,600	52,800	86,400	4800	119,900	42,300

**For plotting purposes only.

to high pressure extraction plus minimum intermediate section flow.

Determining the maximum throttle flow line requires an inspection of Fig. 2A. It is the sum of the desired simultaneous extraction flows plus the minimum flow to exhaust at the desired maximum load.

Fig. 2A also provides information for establishing the maximum load line at the top right of the left hand family of curves on Fig. 1. At the maximum load and a given low pressure extraction flow, read the simultaneous high pressure extraction flow. Add the minimum exhaust flow to the sum of these simultaneous extraction flows to find the throttle flow. Enter Fig. 1 at the maximum load and move vertically to the given low pressure extraction flow. Then move horizontally to the high pressure reference line and vertically to the throttle flow. This is one point of the maximum load limit. Repeat for other low pressure extraction flows to complete the limit line.

Simultaneous Extraction Flow

Each point on a load line on Fig. 2A is found by using Equation 2-1, which is the simultaneous solution

of the two following formulas:

$$F_T = F_e + (F_H \times f_H) + (F_L \times f_L)$$
$$F_T = F_H + F_L + F_e$$

These values are simultaneous total extraction flows from the automatic extraction opening at definite load with minimum exhaust flow.

Feedwater Heating

At a selected load, F_{TP} is the throttle flow with feedwater heating but without automatic extraction. With high pressure automatic extraction of F_H pounds per hour, the throttle flow is increased by (F_H x f_H). Since more feedwater also must be heated for this higher flow, an additional extraction of

$$\frac{(h_T - h_c) \times (F_H \times f_H)}{1025}$$

pounds per hour is required which in turn increases throttle flow by

$$\frac{f_H\,(h_T - h_c) \times (F_H \times f_H)}{1025}$$

pounds per hour. Assuming make-up for the process extraction flows is returned to the system at the condenser hotwell, the throttle flow for double automatic extraction plus feedwater heating at constant load can be found from Equation 2-2.

When determining simultaneous process extraction flows with feedwater heating, the performance with minimum exhaust flow should be calculated first as the result may indicate that a unit with a larger rating should be installed. Basically, Equation 2-3 covers exhaust flows corresponding to throttle flows developed from Equation 2-2. However, with exhaust flow F_e equal to the minimum exhaust flow F_{CM}, Equation 2-3 rearranges to the form marked 2-4. Then at any given load, two values of X are selected and the simultaneous values of Y are found, using the step by step calculation procedure.

Since the feedwater extraction flow is not computed in this program, it is necessary to plot the calculated data twice in order to properly establish the limits of performance. First plot the throttle flow (line 70) vs the high pressure process extraction flow (line 59) on Fig. 2B for each load, and draw straight lines through the points for constant load. Next add on Fig. 2A the high pressure process extraction flow (line 59) vs the low pressure process extraction flow (line 64) for each load, and draw straight dotted lines through the points for constant load.

Limits on Figs. 2A and 2B

Limits of performance on each of these curves come from information plotted on the other. Maximum intermediate flows are found using the general expression intermediate flow is equal to the throttle flow minus the sum of the high pressure process extraction flow and the high pressure feedwater heating flow. This formula is rearranged to the form shown under Equation 2-5 and then solved for throttle flow using the maximum intermediate section flows from Fig. 1. These data are plotted on Fig. 2B, and the intercepts of the extended line with constant load lines are cross-plotted on the dotted part of Fig. 2A.

To establish the maximum high pressure process extraction, extend the dotted constant load lines on Fig. 2A to zero low pressure process extraction flow. Then plot the high pressure process extraction flow at zero low pressure process extraction flow on the same load lines on Fig. 2B, and draw a line through these points. This is the maximum high pressure process extraction limit. The chart then is completed by adding the maximum throttle flow limits given on Fig. 1.

Fig. 3 is the final performance curve for double automatic process extraction with feedwater heating. Intermediate values of process performance (values which do not result in minimum flow to exhaust) may be read from this chart. The included limit lines are obtained

12,500 KW, 1250 psig Pressure, 950 F Temperature, 2.0 in. Hg Absolute Back Pressure
Automatic Extraction at 175 and 80 psig Pressure with Feedwater Heating

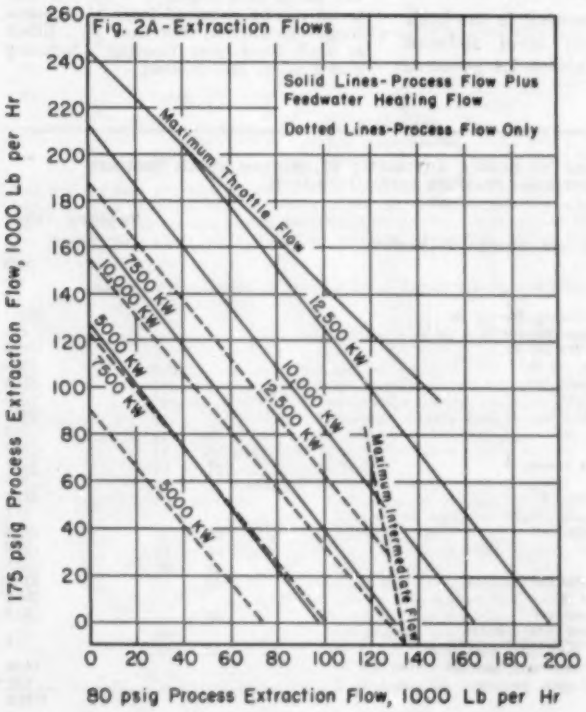
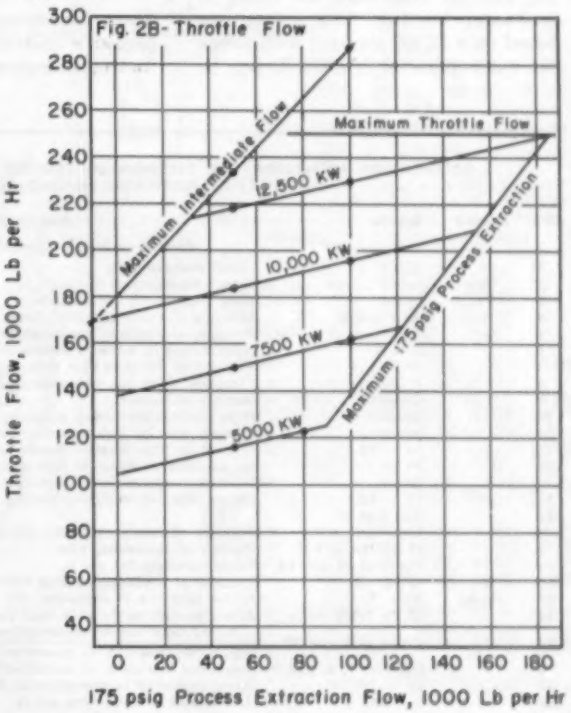
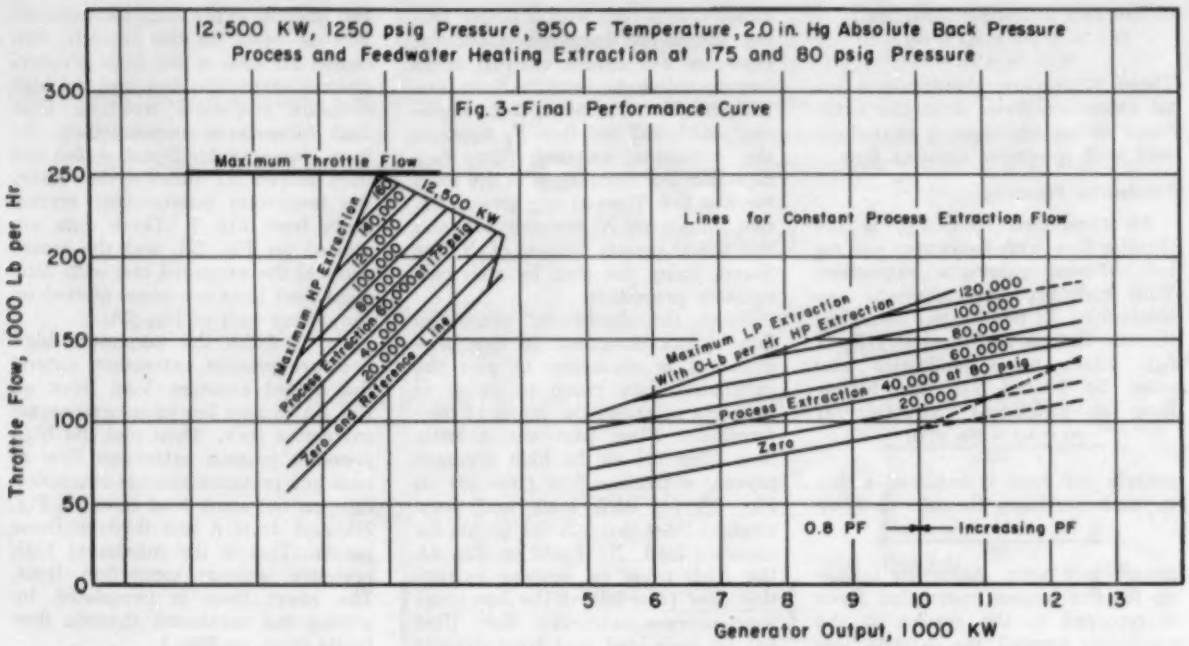


Fig. 2A - Extraction Flows
Solid Lines - Process Flow Plus Feedwater Heating Flow
Dotted Lines - Process Flow Only
Maximum Throttle Flow
12,500 KW
10,000 KW
7500 KW
5000 KW
Maximum Intermediate Flow
175 psig Process Extraction Flow, 1000 Lb per Hr
80 psig Process Extraction Flow, 1000 Lb per Hr





from the data on Figs. 1, 2A, and 2B.

It should be noted that these data do not include enthalpy increase due to boiler feed pump work or the power requirement of the pump. When allowance for these items is required, the net effective input to the pump should be calculated[1] and added to the generator output.

A sample conclusion from comparison of data taken from Figs. 1, 2A, and 2B illustrates the effect of feedwater heating. The values are based on a 12,500 kw load with process extractions of 100,000 lb per hr at 175 psig and 70,800 lb per hr at 80 psig.

From Fig. 1	
Throttle flow, lb per hr	= 200,200
Initial enthalpy	= 1468.1
Enthalpy of feedwater	= 69.1
Heat added, Btu per lb	= 1399.0
Total heat added, Btu per hr	= 280.1 × 10^6
From Figs. 2A and 2B	
Throttle flow, lb per hr	= 229,470
Initial enthalpy	= 1468.1
Enthalpy of feedwater	= 337.6
Heat added, Btu per lb	= 1130.5
Total heat added, Btu per hr	= 259.4 × 10^6

Thus, feedwater heating to the high pressure extraction level reduces fuel consumption about 7.4 percent.

These data assume makeup for process extraction flows is returned at the condenser hotwell. Makeup returned at a higher temperature level would reduce the gain as less extraction would be required. Furthermore, heating to only the lower extraction pressure level would appreciably decrease the fuel savings.

---

(1) Basic data required with this material can be obtained from "Automatic Single Extraction Turbines . . . Effect of Full Feedwater Heating," *Industry and Power*, March 1954.

CALCULATION PROCEDURE FOR DETERMINING PERFORMANCE OF DOUBLE AUTOMATIC EXTRACTION STEAM TURBINES WITH FULL FEEDWATER HEATING TO THE HIGH PRESSURE EXTRACTION LEVEL

Line	Symbol	Source	Description	Numerical Values
			Part 1 — Steam Conditions and Number of Heaters	
1	P_1	Select	Initial pressure, psig	1250
2	T_1	Select	Initial temperature, F	950
3	P_2	Select	Back pressure, in. Hg absolute	2.0
4	H_o	At 1 and 2	Enthalpy of steam at initial steam conditions, Btu per lb	1468.1
5	h_c	At 3	Enthalpy of liquid at condenser pressure, Btu per lb	69.1
6		4 — 5	Heat added in boiler, nonextraction, Btu per lb	1399.0
7		At 1	Enthalpy of liquid at inlet pressure, Btu per lb	580.6
8		7 — 5	"Possible" heat rise of feedwater, Btu per lb	511.5
9		Given	Number of heaters	2
10		Given	High pressure extraction pressure, psia	189.7
11		Given	Pressure drop to high pressure heater, psi	9.5
12		10 — 11	Pressure at high pressure heater, psia	180.2
13	t	At 12	Temperature of steam in high pressure heater, F	373.2
14	θ	Given	Terminal temperature difference, F	10.0
15	t	13 — 14	Temperature of feedwater leaving heater, F	363.2
16		Fig. 4 at 15	$t - h_f$	27.4
17		15 — 16	Enthalpy of saturated liquid, Btu per lb	335.6
18		(1 + 15) × 1.25	Pressure of feedwater, psia	1580
19		Fig. 5 at 15 and 18	Excess enthalpy, Btu per lb	2.0
20	h_f	17 + 19	Enthalpy of feedwater leaving heater, Btu per lb	337.6
21	h_f-h_o	20 — 5	Actual heat rise of feedwater, Btu per lb	268.5
22		21 × 100/8	Actual percent of possible heat rise, percent	52.5
23		Fig. 6 at 9 and 22	Actual reduction in nonextraction heat rate, percent / Theoretical reduction in nonextraction heat rate, percent	61.1
24		Fig. 7 at 1, 2, and 3	Theoretical reduction in nonextraction heat rate, percent	14.76
25		23 × 24/100	Actual reduction in nonextraction heat rate, percent	9.02
26		4 — 20	Heat added in boiler, Btu per lb	1130.5

Part 2 — General Data

27	f_M	Fig. 8	High pressure extraction factor, fraction	0.630
28		1.0 — 27	$(1 - f_M)$	0.370
29		28 × 21 × 27/1025	$(1 - f_M) \times (h_Z - h_C) \times f_M/1025$	0.061
30		28 + 29	$(1 - f_M) + (1 - f_M) \times (h_Z - h_C) \times f_M/1025$	0.431
31	f_L	Fig. 8	Low pressure extraction factor, fraction	0.523
32		1.0 — 31	$(1 - f_L)$	0.477
33		28 × 21 × 31/1025	$(1 - f_M) \times (h_Z - h_D) \times f_L/1025$	0.051
34		32 + 33	$(1 - f_L) + (1 - f_M) \times (h_Z - h_C) \times f_L/1025$	0.528
35		Given	Low pressure extraction pressure, psia	94.7
36		Given	Pressure drop to heater, psi	4.7
37		35 — 36	Pressure at this heater, psia	90.0
38	t	At 37	Temperature of steam in heater, F	320.4
39	θ	Given	Terminal temperature difference, F	10.0
40	t	38 — 39	Temperature of feedwater leaving heater, F	310.4
41		Fig. 4 at 40	$t - h_f$	30.1
42		40 — 41	Enthalpy of saturated liquid, Btu per lb	280.3
43		Fig. 5 at 40 and 18	Excess enthalpy, Btu per lb	2.6
44	h_Z	42 + 43	Enthalpy of feedwater leaving heater, Btu per lb	282.9
45		20 — 44	Heat rise in high pressure heater, Btu per lb	54.7
46		1.0 — 45/960	1.0 — Heat rise/960	0.943

Part 3 — Calculation of Maximum Process Extraction Flow With Minimum Exhaust Flow

50			Load, kw	12,500	12,500	10,000	10,000	7500	7500	5000	5000
51		At 50	Steam rate zero extraction, lb per kwh	8.82		8.42		9.89		10.44	
52		6 × 51	Heat rate zero extraction, Btu per kwh	11,220		11,790		12,750		14,600	
53		52 × 25/100	Actual reduction in zero extraction heat rate, Btu per kwh	1910		1960		1150		1320	
54		52 — 53	Heat rate zero automatic extraction with full feedwater heating, Btu per kwh	10,210		10,720		11,570		13,280	
55	F_{TP}	54 × Load/26	Preliminary throttle flow lb per hr	112,900		94,800		76,750		58,700	
56		Fig. 10 at 21 and 9	Preliminary total extraction as percent of throttle flow	23.4		23.4		23.4		23.4	
57		55 × 56/100	Preliminary total extraction, lb per hr	26,400		22,200		17,960		13,750	
58	F_{CP}	55 — 57	Preliminary condenser flow, lb per hr	86,500		72,600		58,790		44,950	
59	X	Select	High pressure process extraction, lb per hr	50,000	100,000	50,000	100,000	50,000	100,000	50,000	80,000
60	F_{CM}	Given	Minimum exhaust flow, lb per hr	6000	6000	6000	6000	6000	6000	6000	6000
61		59 × 30	$X [(1 - f_M) + (1 - f_M) \times (h_Z - h_C) \times f_M/1025]$	21,550	43,100	21,550	43,100	21,550	43,100	21,550	34,500
62		60 + 61		27,550	49,100	27,550	49,100	27,550	49,100	27,550	40,500
63		58 — 62		58,950	37,400	46,050	23,500	31,240	9690	17,400	4460
64	Y	63/34	Low pressure process extraction, lb per hr	111,600	70,800	85,350	44,500	59,200	18,350	32,950	8400
65		55	Preliminary throttle flow, lb per hr	112,900	112,900	94,800	94,800	76,500	76,500	58,700	58,700
66		27 × 59	$f_M \times X$	31,500	63,000	31,500	63,000	31,500	63,000	31,500	50,400
67		27 × 21 × 66/1025	$f_M \times (h_Z - h_C) \times (f_M \times X)/1025$	5200	10,400	5200	10,400	5200	10,400	5200	8320
68		31 × 64	$f_L \times Y$	58,400	37,050	44,650	23,300	30,950	9600	17,260	4390
69		27 × 21 × 68/1025	$f_M \times (h_Z - h_C) \times (f_L \times Y)/1025$	9640	6120	7370	3850	5120	1590	2850	720
70	F_T	Add 65 to 69	Throttle flow, lb per hr	217,640	229,470	183,520	195,350	149,270	161,098	115,510	122,530
71		70 × 46	F_T (1.0 — Heat rise/960)	205,300	216,400	173,200	184,200				
72		59	High pressure process extraction flow, lb per hr	50,000	100,000	50,000	100 000				
73	F_I	71 — 72	Intermediate section flow, lb per hr	155,300	116,400	123,200	84,200				

Part 4 — Calculation of Maximum Intermediate Section Limit Line for Fig. 2B

Note: In Terms of Throttle Flow and High Pressure Process Extraction Flow

74	Given	Maximum intermediate section flow, lb per hr	170,000	170,000	170,000	170,000
75	74/46	Maximum intermediate section flow / 1.0 — Heat Rise/960	180,200	180,200	180,200	180,200
76	59/46	HP Process Flow / 1.0 — Heat Rise/960	53,000	106,000	53,000	106,000
77	75 + 76	Maximum allowable throttle flow*, lb per hr	233,200	286,200	233,200	286,200

* At selected load and high pressure process extraction flow with maximum intermediate section flow. This is usually a fictitious value, as it may be either higher or lower than line 70. Plot points on Fig. 2B, which establish the maximum intermediate flow line. At the intersection of this line and constant load lines, read the high pressure process extraction flow. On Fig. 2A at each of the loads in question, spot the high pressure process extraction flow. A straight line through these points will establish the maximum intermediate section flow line. At low load, high pressure process extraction flow may be negative.

Part 5 — Calculation of Throttle Flow, Exhaust Flow, and Intermediate Section Flow With Condenser Flow Above Minimum Value

Note:—Lines 1 to 58 are the same as for Minimum Exhaust Flow calculations.

50		Select	Load, kw	12,500	10,000	7500	5000	12,500	10,000	7500	5000
80	X	Selected	High pressure process extraction flow, lb per hr	0	0	0	0	50,000	50,000	50,000	50,000
81	Y	Selected	Low pressure process extraction flow, lb per hr	100,000	100,000	100,000	100,000	50,000	50,000	50,000	50,000
82		55	Preliminary throttle flow, lb per hr	112,900	94,800	76,750	58,700	112,900	94,800	76,750	58,700
83		27 × 80	$f_M \times X$	0	0	0	0	31,500	31,500	31,500	31,500
84		27 × 21 × 83/1025	$f_M \times (h_Z - h_C) \times (f_M \times X)/1025$	0	0	0	0	5200	5200	5200	5200
85		31 × 81	$f_L \times Y$	52,300	52,300	52,300	52,300	26,150	26,150	26,150	26,150
86		27 × 21 × 85/1025	$f_M \times (h_Z - h_C) \times (f_L \times Y)/1025$	8620	8620	8620	8620	4315	4315	4315	4315
87	F_T	Add 82 to 86	Throttle flow, lb per hr (Check with maximum throttle flow)	173,820	155,720	137,670	119,620	188,865	161,965	143,915	125,865
88		80 × 30	$X [(1 - f_M) + (1 - f_M) \times (h_Z - h_C) \times f_M/1025]$	0	0	0	0	21,550	21,550	21,550	21,550
89		81 × 34	$Y [(1 - f_L) + (1 - f_M) \times (h_Z - h_C) \times f_L/1025]$	52,800	52,800	52,800	52,800	26,400	26,400	26,400	26,400
90		88 + 89		52,800	52,800	52,800	52,800	47,950	47,950	47,950	47,950
91	F_E	58 — 90	Exhaust flow = condenser flow, lb per hr (Check with exhaust flow limits)	33,700	19,800	8990	—7850	38,550	24,650	10,840	—3000
92		87 × 46	F_T (1.0 — Heat rise/960)	163,900	146,900	129,800	112,800	169,700	152,700	135,700	118,600
93		80	High pressure process extraction flow, lb per hr	0	0	0	0	50,000	50,000	50,000	50,000
94		92 — 93	Intermediate section flow, lb per hr (Check with intermediate section flow limits)	163,900	146,900	129,800	112,800	119,700	102,700	85,700	68,600

If line 94 exceeds maximum design value, follow program and steps as given under lines 74 to 77 inclusive.

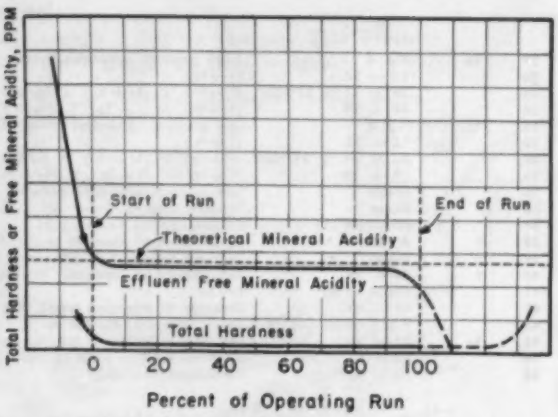


Fig. 1 — Variation in effluent composition during the operating run of a typical hydrogen cation exchanger.

Fig. 2 — Photograph at left shows application of an Enditrol to a hydrogen cation exchanger installation.

Electrical Determination of Endpoints For Ion Exchanger Runs

MARTIN E. GILWOOD
Director of Research
The Permutit Company

ALTHOUGH THOUSANDS of hydrogen cation exchangers are in operation, the end of the operating run has had to be determined either by a chemical titration, or the run has been terminated after a fixed volume of water has passed through the unit. Control by employing continuous recording pH meters has been unsuccessful, because only small changes in pH are encountered at the end of the runs.

Present Test Methods

Chemical titration is a tedious, time-consuming, and labor-wasting task. It is not simply a matter of making a single titration. A series of titrations is required, and if the intervals between titrations are too long, it is easy to overrun the unit.

On the other hand, if the operating run is terminated when the water meter indicates that a fixed volume has passed through it, there still can be an appreciable amount of unused residual capacity in the unit. This is because in setting this fixed volume, a factor of safety must be used to prevent overrunning. Also, with waters of varying composition, this method of operation means many resettings of the meter to meet composition variations. Abundant opportunities are offered to overrun or to underrun the unit for these changes can take place with startling rapidity.

The need for an automatic device for indicating the end of the operating run of a hydrogen cation exchanger has long been felt. Also, there has been a need for determining the ends of the operating runs of highly basic anion exchanger units, especially when silica removal is important.

An electrical device has been developed which can be used not only for indicating the end of the operating run but also for automatically initiating the operation of existing regeneration equipment. In developing this control (Enditrol,* The Permutit Company), advantage was taken of the fact that the columnar bed of an ion exchanger, when operated downflow, has its useful exchange capacity exhausted first at the top. This exhaustion then slowly proceeds downwardly during the operating run.

With a hydrogen cation exchanger, the calcium, magnesium, and sodium cations are taken up from the water passing through the bed, and hydrogen ions are given in exchange for them. The effluent, therefore, contains amounts of carbon dioxide, hydrochloric acid, and sulfuric acid proportional to the amounts of bicarbonates, chlorides, and sulfates present in the raw water. With the sodium salts in

* Gilwood, U.S. Patent 2,628,194—Assigned to The Permutit Co.; Sard, U. S. Patent 2,628,191—Assigned to The Permutit Co.

water, the exchange is not quite complete and there is usually a slight slippage of sodium chloride and sulfate through the bed.

Changes in Composition

During the bulk of the operating run the free mineral acidity of the effluent remains quite constant, but on approaching the end of the run, it decreases very rapidly. For most uses, the operating run is terminated when the free mineral acidity falls to 90 percent of its level during the bulk of the run. For special uses, the run may be terminated somewhat earlier. Fig. 1 illustrates the changes in composition during a run on a water of constant composition when using a typical hydrogen cation unit as shown in Fig. 2.

Tap Locations

Since decreases in acidity proceed slowly downwardly through the bed during the run, it appeared that, if samples were drawn off at a level somewhat above the bottom of the bed, the difference in acidity between these samples and the final effluent could be used to indicate the end of the run. Experiments were made with taps inserted in levels at various distances from the bottom of the bed. Depending largely on the composition of the water and the specified endpoint of the run, the tap may, in practice, range from about 4 to 8 inches above the bottom of the bed.

As shown in Fig. 3, a small stream of water, drawn from this tap continuously during the operating run, is passed through a conductivity cell. Its conductivity is compared, in the Enditrol, with the conductivity of the effluent from the bottom of the exchanger. During the greater part of the run, the conductivities of both the upstream sample and the final effluent are nearly identical. But since hydrogen ions have an appreciably higher conductivity than the calcium, magnesium, and sodium ions which they have replaced, the effluent, near the end of the operating run, has a higher conductivity than the upstream sample taken from the tap. Depending on the position of the upstream tap the ratio of the conductivity of the effluent at this stage, to that of the upstream sample may range from 1.2 to as much as 3.0 near the end of the run.

Control Accessories

This control may be equipped with a relay, so that it signals the end of the operating run by an alarm bell or light, or with electrical controls, so that the operation of the ion exchange unit is made completely automatic. Fig. 4 illustrates a typical variation in the conductivities ratio during the operating run of a hydrogen cation unit.

Waters of variable composition may be handled as accurately as waters of constant composition, for changes in composition of the raw water would change both conductivities proportionately. Furthermore, the rate of travel of the water downwardly from the tap to the effluent outlet is much faster than any appreciable change which could take place in the composition of the raw water.

Demineralizing Units

Equally applicable to the operation of anion exchanger units, the Enditrol is especially valuable in the operation of strongly basic anion exchangers for demineralizing installations where silica removal is of importance. In systems of either the "two-step" or "mixed bed type", the effluent conductivity does not change appreciably at the time that silica begins to slip through into the effluent. Thus the usual conductivity determinations made on the demineralizer effluent indicate the end of the operating run.

Since silicic acid is such an extremely weak acid, it does not ionize sufficiently to affect to an appreciable extent either the pH of the effluent or its conductivity. However, since in a "two-step" unit the strongly ionized hydrochloric and sulfuric acids follow the silica, the sampling point can be placed far enough upstream so that the acid's presence can be detected before silica appears in the effluent. The presence of hydrochloric and sulfuric acids in the upstream tap sample causes the conductivity of the sample to rise rapidly, thus indicating the end of the run.

When the upstream tap is properly located, the rise in conductivity of this sample will occur when the silica just starts to rise in the effluent. Thus, for this application it is not absolutely necessary to compare the conductivity of the upstream tap and the effluent. The end of the run is determined by merely checking the upstream tap for an increase in conductivity.

A similar arrangement also has been employed to indicate the end of a mixed bed demineralizing unit run. In this instance the run can be terminated at the first increase in effluent silica and not when the conductivity of the effluent rises.

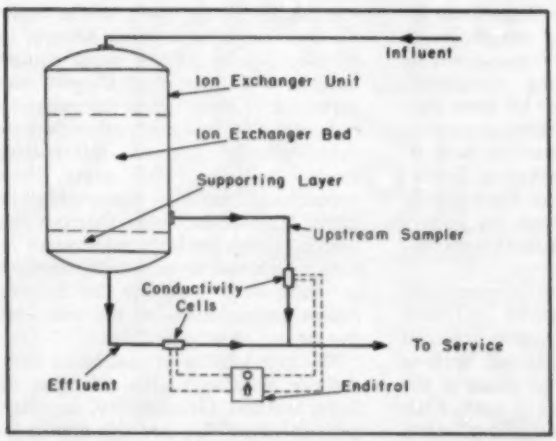


Fig. 3 — Flow diagram shows how Enditrol is applied for electrically determining ion exchanger run endpoints.

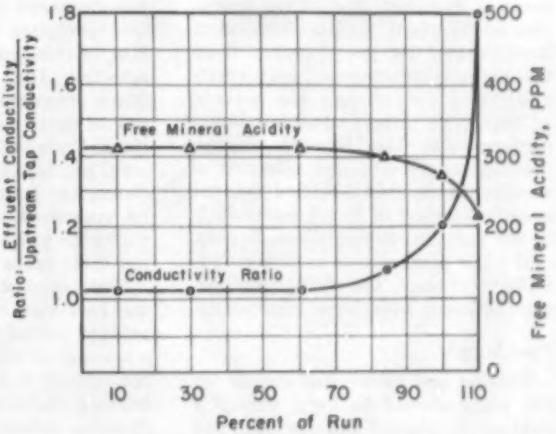


Fig. 4 — Variation in the conductivity ratio during the operating run of a typical hydrogen cation exchanger.

Cut-away photo illustrates the construction details of the clips, racks, and chains on a typical traveling grate stoker.

Coal Burning Equipment . . . Application and Selection

EARLE C. MILLER
Research Engineer
Riley Stoker Corp.

A FULL UNDERSTANDING of the limitations and advantages of the various methods of firing is paramount when selecting coal burning equipment. Selection should be made only after long and careful consideration, for once firing equipment is installed, the future operation of the plant will be blessed or handicapped by the decision. Once the plant is constructed, only costly rebuilding can change the method of firing. To obtain optimum boiler performance, the furnace design, plant arrangement, and selection of auxiliaries should all be tied into the specific method of firing selected. It is not easy to change these factors, and while some plants have been rebuilt to change the firing method, such changes have been very costly.

Fuel Supply

Present and future fuel supply for the plant should be very carefully studied. It should not be assumed that the fuel supply will be the same as some nearby installation. Quite frequently, even a distance of 50 miles will change the proper pattern for fuel selection. Extensive data have been compiled by various coal marketing associations for guidance in the engineering of new plants. The Bituminous Coal Research Inc. has prepared an excellent form for the tabulation of fuel specifications. Use of this form is a great aid in selecting fuel burning equipment. Many areas are served by more than one of these coal marketing associations. Each is fully familiar with its own production, marketing procedures, and future plans. Each should be consulted and given an opportunity to present the facts concerning their fuels.

The complex factors presented by the fuel picture must be balanced against size of unit, load range, and a number of other variables. Serious consideration should be given to the burning characteristics of fuels. Free swelling index, agglutinating value, and friability are factors not always considered, but they are important.

Proximate analysis is important, for it reveals the heating value, ash content, moisture content, volatile content, and percent of sulfur. But these alone will not complete the picture of satisfactory operation. For example, volatile content is frequently thought to reveal the tendency of fuel to smoke. Often it is assumed that a high volatile coal will smoke more than low volatile coal. However, some spreader stokers operating at one-tenth load have clear stacks with certain Eastern high volatile coals, while other Eastern coals have been known to develop smoke on the same equipment at a quarter load. Careful observation of these units immediately indicates that there are other factors than volatile content influencing smoke emission. This same phenomena is readily discernible in many Midwestern coals. Current research on this problem may result in data which can be as readily applied to equipment selection as is the fusion temperature of the ash and the factor of grindability.

The grindability of coal has a very definite relation to the selection of firing method. Grindability, together with the unit size, are the dominating factors in the choice between pulverizers and spreader stokers, as

fuel size consist and, most particularly, the uniformity of size consist greatly influences stoker operation. Uniformity of size consist is a major item in satisfactory operation of all types of very large stokers.

Single Retort Underfeeds

Single retort underfeed stokers dominate coal firing in the boiler units under 10,000 lb of steam per hr. They are also used for the majority of installations between 10,000 and 25,000 lb per hr. There are three general designs available in this stoker, with each design popular in a definite size range. The three types are: (a) worm feed with stationary grates, (b) ram feed with stationary grates, and (c) ram feed with moving grates. The worm feed stoker is most popular in sizes below 5,000 lb per hr because in these small units it does an adequate job at a favorable initial investment. Most of the coal producing areas prepare special coal for these worm feed stokers, and the small premium paid for optimum coal size is easily justified.

The ram feed and stationary grate type of single retort underfeed stoker has retained its position in the coal burning field for many years. It has resisted the inroads of the dump grate spreader stoker in the 5,000 to 20,000 lb per hr class even though it is very sensitive to the characteristics of the fuel fed to it. In this size range the lower capital investment of an underfeed installation as compared to the investment in a spreader stoker is likely to offset the difference in fuel costs.

Since fewer auxiliaries are required, the single retort underfeed installation has a price advantage over a spreader stoker. This stoker, if properly sized and supplied with correct fuel, does not require a dust collector for fly ash elimination, and consequently most units operate on natural draft. On the other hand, very few ordinances permit the installation of spreader stokers without high draft loss dust collectors, which necessitates the use of an induced draft fan. The additional cost of the collector and fan, plus the added building cost, places a severe handicap on the spreader stoker that can only be justified if a high load is to be maintained.

Low burning rates must be used with single retort stokers because forced firing complicates operating procedures. Fortunately, in small units the furnace provides ample space for a liberal grate area, and more often than not the standard small boiler has surplus space. Furthermore, the addition of grate surface to a stoker does not add proportionally to the cost. A 25 percent increase in grate surface will add only 5 percent to the purchase price of the stoker. To assure a satisfactory single retort underfeed stoker installation, select the size from Table I.

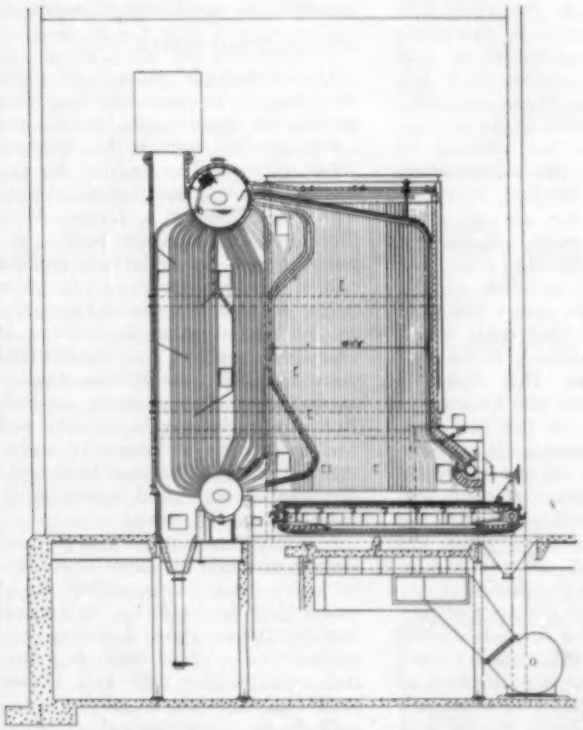
Fuel for the single retort stoker with stationary grate should be se-

TABLE 1 — SINGLE RETORT STOKER BURNING RATES

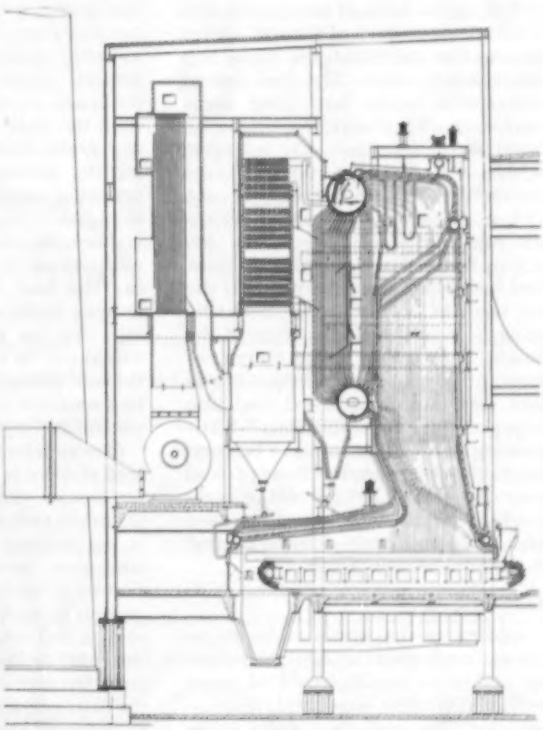
In pounds of coal per hr per sq ft of stoker area

Furnace cooling, fraction	*Ash fusion temperature, deg F*	
	2200	2400
0.20	28*	31*
0.34	30*	34*

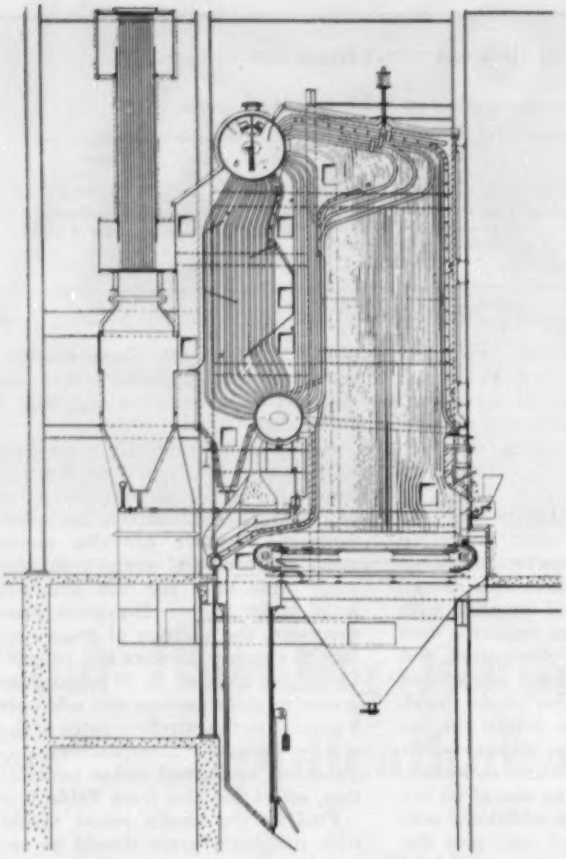
*Burning rates are based on 13 percent CO_2 in the gases leaving the furnace when firing bituminous coal containing 10 percent ash or less. If ash is 10 to 12 percent deduct 2 pounds, and if ash is 12 to 15 percent deduct 4 pounds from the above values.

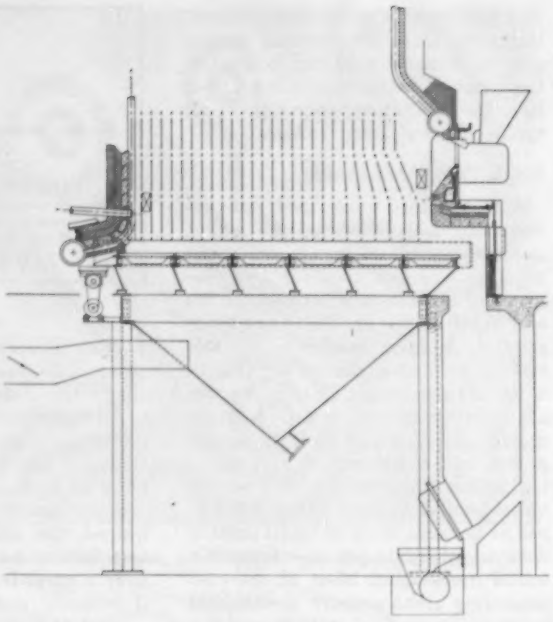


Traveling grate stoker designed for bituminous coal.



Traveling grate stoker designed for anthracite coal.





Above. Details of a spreader stoker with vibrating grates.

Left. Traveling grate spreader stoker — rear ash discharge.

lected on the basis of size consist and fusion temperature of the ash. Other factors are important, but these two outrank all others. The fuel bed of the single retort has three basic characteristics which are conducive to clinker formation: (a) agitation within the fuel bed which mixes the molten ash with the burning coal, (b) a reducing atmosphere within the fuel bed which lowers the ash fusion temperature, and (c) a thick fuel bed which prevents much of the hot ash and burning coal from radiating heat to the cold surface of the boiler. High fusion temperatures reduce the possibility of clinker formation, and double screened coal also improves fuel bed conditions by improving air flow through the bed and improving the natural flow of coal over the grate. Certain caking coals —which cannot otherwise be used on a stationary grate—can be burned if the proper size is selected.

Moving Grates

Adding moving grates to the single retort underfeed stoker increases its ability to handle coals of more widely divergent sizes and characteristics. The stationary grate relies on gravity to move the coal from the center retort to the sides. The natural flow of coal is extremely variable being influenced by size consist, swelling index, and the tendency to cake. These variables limit the stoker width of the stationary grate design. The addition of moving grates to the single retort provides control for fuel distribution and permits the use of wider stokers. Moving grate stokers are effective up to 30,000 lb of steam per hr. The fuel bed agitation of the moving grate single retort also permits the use of caking coals which would not be satisfactory in the stationary grate units. This stoker is less sensitive to fuel size because of controlled motion of the fuel bed.

One standard practice with underfeed stokers is the use of overfire air for smoke elimination. Careful application and control of overfire air is particularly important when the start-stop method of combustion control is used. This sequence of operation is such that a charge of raw coal is fed into the furnace during the "on" period. When the forced draft fan and stoker stop, the heat of the furnace and fuel bed continues to drive off the volatile. Smoke will result unless the supply of overfire air remains on during this period.

Multiple Retort Stokers

Use of multiple retort stokers was once popular in the power field. This popularity has rapidly faded, yet conditions still remain that warrant its installation. The fault of the underfeed stoker is that it does not perform well when it is forced. With increasing size of power boilers, the burning rate on underfeed stokers had to be greatly increased in order to get the greatest possible capacity in the least possible floor space. If an ample supply of high quality coal were available, the system worked as well as any other firing method. But with no leaway in capacity and fuel quality on a downward trend, the multiple retort stoker fired units dropped capacity and maintenance costs frequently soared.

Multiple retort stokers have been largely replaced by spreader stokers in boiler sizes below 200,000 lb of steam per hr—and by pulverized coal in larger sizes. Industry reported total sales of multiple retort stokers at 16 for 1952 and 12 for 1953. Multiple retorts still are installed for institutional heating where peak loads seldom are en-

countered and where high grade coal is readily available. Grate area should be generous to assure ease of operation as shown by the recommended burning rates in Table 2.

Traveling and Chain Grate Stokers

Traveling grate and chain grate stokers have long been popular for the free burning bituminous coals. The burning action of these units is identical, the principal difference being in construction details. The surface of the traveling grate consists of small clips mounted on grate racks which are carried by chains. The clips of the chain grate form the chain as well as the grate surface.

These stokers carry the fuel bed through the furnace without any agitation. This is the basic difference between this method and underfeed stoker firing. Traveling and chain grate stokers are most effective with coals that are not suited to multiple retort underfeed stokers. Free burning coals are preferred, but with proper size consist, caking coals of relatively high swelling indices can be used. Fuel sizes range from 1 in. x O mesh for the free burning coals up to 1½ in. x ⅜ in. for coking coals with a swelling index of 7.

Traveling grate and chain grate stokers will burn screenings of minus ⅜ in. in the free burning coals, but with this fine coal, high carbon loss in the ashpit and in the fly ash is to be expected. Most operators state that the traveling grate stoker can meet the ASME dust emission code without the use of a dust collector provided the fuel size is correct and the furnace design is proper. Coals having ash content of 30 percent can be burned effectively, and some special installations have been made for even higher ash content coals.

For best results, traveling and chain grate stoker installations require tempering of the coal, and provision should be made for the addition of water or steam to the fuel to bring moisture up to approximately 15 percent. Tempering should be uniform, as these stokers are sensitive to segregation of both size and moisture. Unless the fuel consist is completely uniform throughout the width of the grate, the fuel bed will not burn uniformly and a "tail" of burning coal will run into the ashpit.

Furnace design is an important factor in the performance of bituminous coal burning traveling grate stokers. If the arrangement does not include a rear arch, the traveling grate will have a burn-out zone where the fire is thin and the excess air is high. This can be avoided by using a properly designed rear arch to divert the excess air into the rich zone of burning volatiles, thus decreasing the excess air and at the time reducing the possibility of smoke. Many installations are made without rear arches to reduce initial cost, and the mixing of the rich and lean furnace gases is attempted with overfire air. This, however, is only partially effective, and high excess air and smoke are common. Optimum performance can be obtained only by using both the rear arch and the overfire air.

Stoker grates must provide a liberal burning rate. Undersizing the stoker will result in fly ash emission and high carbon loss in the ashpit. The long, narrow stoker is preferred to the short, wide stoker of the same effective grate area as increasing width makes the task of maintaining uniform fuel conditions more difficult. Table 3 gives standards for grate and furnace design which will provide good over-all performance.

The traveling grate stoker is used mostly in industrial power plants having steady and sustained loads of 20,000 to 125,000 lb of steam per hr. Under such load conditions the stoker can operate on full automatic combustion control with only occasional manual readjustment of the zone dampers. In recent years, these units have regained some of the ground lost to spreader stokers. Their ability to operate without dust collectors, some improvements in design (such as the hydraulic grate drive), improved overfire air systems, and continuous cleaning siftings recovery systems have stimulated renewed interest in the traveling grate stoker.

Spreader Stokers

Use of spreader stokers should be carefully considered when steaming capacities of 10,000 to 200,000 lb per hour are required.[1] These stokers are of three basic designs: (a) stationary grate, (b) dumping grate, and (c) continuous ash discharge. Selection of the type to be installed requires a balance between investment and operating costs, with stationary grates usually applied in the smallest capacity boilers and the traveling grate installed in the largest units. The cost of traveling grate units discourages their use in the smaller sizes, although new low cost continuous ash discharge designs are gradually replacing dumping grates in many instances.

With self cleaning grates, the movement is identical to the action of vibrating conveyors. The fuel bed moves progressively to the discharge of the stoker without excessive agitation which would promote objectionable clinkers and high grate maintenance. This grate combines many advantages of both dumping and traveling grates. There are no moving parts within the furnace, and no lubrication is needed. The layout is flexible and self cleaning.

This stoker provides for discharge of ash in either the front or the rear, an important factor in low load operation. The rear end of the grate can be inactivated, thereby restoring the burning rate near the feeders. This double ash discharge is, at times, a great aid in plant design.

When comparing the spreader with underfeeds and traveling grate stokers, it must be recognized that a dust collector will be required to reduce dust emission to an equivalent basis. Although the underfeeds and the traveling grate stokers will create fly ash nuisance if burning rates are too high and coal size or burning characteristics are wrong, these stokers will operate without dust collectors if properly engineered and operated. At present it does not seem as though the spreader stoker without a collector can as-

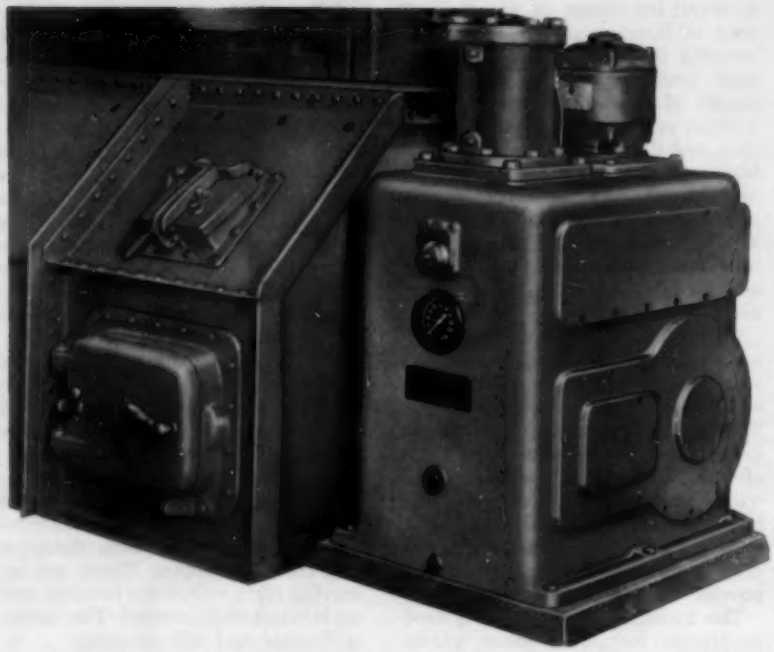
TABLE 2 — MULTIPLE RETORT STOKER BURNING RATES

In pounds of coal per hr per sq ft of stoker area

Stoker length, ft	Ash fusion temperature, deg F	
	2200	2500
11	35	40
14	30	35

TABLE 3 — TRAVELING GRATE STOKER RELEASE RATES FOR BITUMINOUS COAL

Ash fusion temperature, deg F	1900	2200 and above
Release rate, Btu in fuel per hr per sq ft of grate area	425,000	550,000



Hydraulic grate drives are used extensively for traveling grate type stokers.

sure dust free operation, except in unusual circumstances.

The addition of a high resistance dust collector eliminates the possibility of natural draft operation. This need for a dust collector and an induced draft fan is important when choosing between the underfeed and the spreader stoker in the East, and between the traveling grate and the spreader stoker in the Midwest. However, certain favorable characteristics of spreader stokers often outweigh the additional cost of the dust collector and the induced draft fan. If high efficiency units are desired, heat recovery equipment must be used with any method of firing, and the introduction of air-heaters or economizers requires the use of induced fans. Then, the dust collector is the only extra piece of equipment in the spreader layout.

Advantages of the spreader stoker as compared to the underfeeds and the traveling grates are: (a) less sensitivity to fuel characteristics, (b) high daily efficiency, and (c) lower maintenance — especially when compared to the underfeed.

It has been pointed out[1] that all solid fuels from lignite to high grade bituminous coals burn well on spreader stokers, size consist and uniformity of size being the most critical factors. While it is quite true that there is considerable difference in performance between various coals of similar proximate analysis, it is equally true that almost any fuel will develop continuous full load with spreader stoker firing. This is not true for underfeeds and traveling grates, for on these stokers any great reduction in coal quality will almost certainly result in reduced capacity, reduced efficiency, or both.

Optimum burning rates on spreader stokers are 250,000 to 600,000 Btu per sq ft per hr with efficiency being nearly constant over this range. Recognition of this fact and a careful study of the plant load factor dictate the proper stoker size. Table 4 is a guide to spreader stoker grate and furnace selection.

Spreader Stokers vs Pulverizers

There is considerable competition between the spreader stoker and the pulverizer in steam generating capacities of 100,000 to 200,000 lb per hr. As the size increases the pulverizer gains its advantage while the spreader stoker gains its advantage as coal quality and grindability decrease. Some stoker manufacturers talk in terms of spreader stoker units of 500,000 lb of steam per hr, but few units are installed with steaming capacities in excess of 250,000 lb per hr. The larger the stoker the greater must be the attention given to fuel size consist and size segregation. In addition, bunker and coal spout designs are more critical.

Both the pulverizer and the spreader stoker are capable of operating with wide variations in fuel. Except insofar as the variations in fuel might affect pulverizer capacity, the pulverizer is even more versatile than the spreader stoker. The influence of coal quantity and grindability on pulverizer capacity and cost is shown in Table 5.

Either spreader stoker or pulverizer fired units can be easily adapted to burn gas and oil, but the advantage is with the pulverizer. Addition of burners and burner ducts to the spreader stoker installation takes away some of its price advantage, because the burners of the pulverizer units can be modified to handle coal, oil, and gas at a relatively insignificant cost. Pulverizers also have an operating advantage over spreader stokers in that greater operating care must be exercised when firing oil or gas on spreader

TABLE 4 — TRAVELING GRATE SPREADER STOKER RELEASE RATES

Recommended grate heat release rates

Btu in fuel per hr per sq ft of grate area

Continuous boiler capacity, lb per hr	100,000	200,000	300,000
Release rate for maximum continuous load	450,000	700,000	725,000
Release rate for 2 hr peak loads	725,000	775,000	800,000

Recommended furnace heat release rates

Btu in fuel per hr per cu ft of furnace volume

Load	Refractory furnace	Water cooled furnace
For Iowa coal, subbituminous coal and lignite		
Recommended continuous	25,000	22,000
Maximum continuous	25,000	25,000
Two hour peak	35,000	35,000
For bituminous coals other than shown above		
Recommended continuous	30,000	25,000
Maximum continuous	30,000	30,000
Two hour peak	35,000	40,000

stoker units than is required for pulverizer units. An adequate protective covering of ash must be maintained on the idle stoker grates to prevent overheating. Feeders also must be protected from excess heat. Pulverized coal furnaces need no special attention when changing to oil or gas.

Pulverized Coal Firing

Pulverized coal fired units dominate the solid fuel field in steam generating capacities above 200,000 lb per hr. These units have demonstrated an ability to remain in continuous service for longer periods than have other methods of firing. This great advantage results from the fact that the firing equipment consists of multiple independent units located outside of the furnace. Maintenance and adjustment of the pulverizers and exhausters can be made without a boiler outage.

Systems using pulverizers do require periodic sizing of the balls, inspection and adjustment of the grinding elements, and ultimate replacement of the grinding elements. In addition to routine maintenance, emergency maintenance of gears and bearings can be expected. In fact, pulverizers, except for ball tube mills, require maintenance as frequently as spreader stokers—and generally at a greater cost. A well operated traveling grate also requires less maintenance than a pulverizer. However, the loss of one pulverizer, while reducing the boiler load, will not take it out of service. Careful maintenance inspection of a stoker means a boiler outage.

Pulverizers should be selected with enough excess capacity to provide for: (a) reduced grindability, (b) reduced heating value and the consequent increase in quantity, and (c) increased moisture. The first two are commonly recognized and provided for, but the adverse effect of moisture on pulverizer capacity can be overlooked. The installation of a crusher dryer ahead of or built into the pulverizer will maintain capacity as it permits the use of air temperatures much higher than was heretofore possible. For example, in one series of tests using 20 percent moisture fuel, the air temperature dropped from 800 F at the crusher inlet to 235 F at the outlet. Detailed information on the application of the crusher dryer to attrition type and ball tube mill pulverizers has been published.[2]

Anthracite Firing

Anthracite consumers find their available firing methods confined to rather rigid size brackets. The industrial anthracite stoker should be of the single retort underfeed type in capacities up to 10,000 lb of steam per hr. This stoker will handle No. 1 and No. 2 buckwheat very effectively, but is not recommended for No. 4 buckwheat. Traveling grate stokers are available for the very small anthracite coal sizes, but the additional capital investment in both stoker and furnace design of the traveling grate stoker as compared to the underfeed stoker can seldom be justified for boilers with steam capacities below 10,000 lb per hr.

Most engineers are acutely aware of the need for versatility of fuel burning equipment. Even in very small plants, it is essential that the stoker be able to handle an alternate fuel in the event that the supply of the basic fuel is cut off. Here the small underfeed stoker is exceptional, for with minor adjustments it can be converted to burn bituminous coal with equal capacity and performance as that obtained with the anthracite. Burning rate standards are shown in Table 6.

Boilers with steam capacities ranging from 10,000 to 250,000 lb per hr are generally fired by the traveling grate and chain grate stokers. Traveling grate stokers can handle No. 4 buckwheat with ease, if the furnaces are properly designed.

The traveling grate stoker arrangement for anthracite firing does not have the same furnace characteristics and arch design normally used for bituminous coal. In emergencies, however, a substantial load can be carried with bituminous. In fact, if necessary, the rear arch of an anthracite unit could be readily rebuilt for a permanent change to bituminous coal.

Pulverized anthracite is a very limited field, but with low cost anthracite readily available, any units larger than 250,000 lb of steam per hr could use this method of firing. The pulverizer must be of the ball tube mill type, and the furnaces must be especially designed to handle this very low volatile fuel. Mr. T. B. Richards presented a paper[3] on this subject which is available for those wanting additional information.

TABLE 5 — INFLUENCE OF COAL QUALITY AND GRINDABILITY ON PULVERIZER AND SPREADER STOKER COSTS

Steam load, lb per hr	175,000	175,000	175,000	175,000
Heating value of coal, Btu per lb	14,000	12,000	10,000	8,000
Coal consumption, lb per hr	18,000	19,000	23,000	28,000
Grindability of coal	90	70	60	50
Relative cost, spreader stoker	1.0	1.0	1.0	1.0
Relative cost, pulverizer	1.1	1.25	1.4	1.6

TABLE 6 — RECOMMENDED STANDARDS FOR FIRING ANTHRACITE

Single Retort Underfeed Stokers

Size of buckwheat	No. 1	No. 2
Burning rate, lb per hr per sq ft of grate area	20	20

Traveling Grate Stokers

Size of buckwheat	*Release rates, Btu in fuel per hr per sq ft of grate area*		
	A	B	C
No. 4	450,000	400,000	350,000
No. 3	460,000	420,000	390,000
No. 2	470,000	470,000	470,000

A. Fly ash collection from back boiler passes, air heater hoppers, and dust collector hoppers returned to furnace for reburning.

B. Fly ash collection in back boiler passes and air heater hoppers returned to furnace for reburning.

C. No collection returns.

BIBLIOGRAPHY

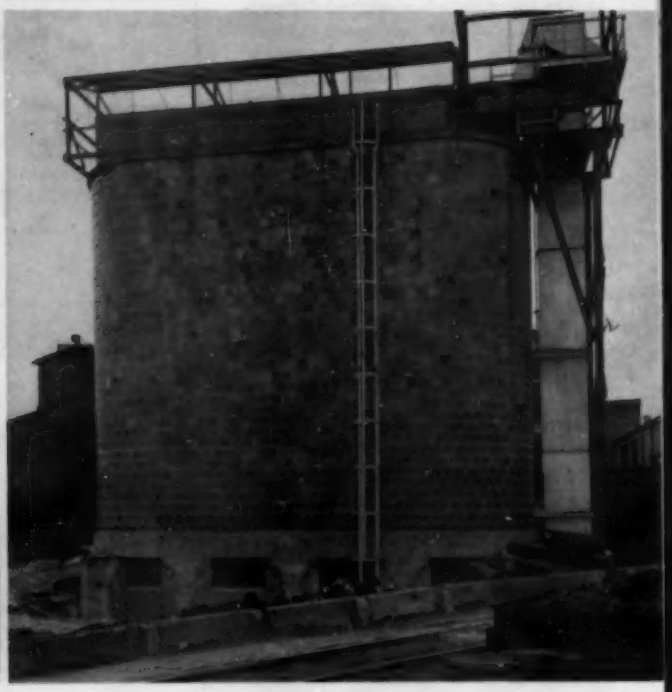
(1) Miller, Earle C., "Some Engineering Considerations in the Application of Spreader Stokers", *Industry & Power*, March 1953

(2) Rogers, W. C., "Mill Drying in Pulverizing High Moisture Coals", *ASME Paper No. 53-S-47*

(3) Richards, T. B., "Operation of Sunbury Steam Electric Station Using Pulverized Anthracite Fuel", *ASME Paper No. 52-FU-3*

(4) Barkley, J. F., "Significance of Laboratory Tests of Coal & Coke for Combustion", *Bureau of Mines Information Circular 7619*

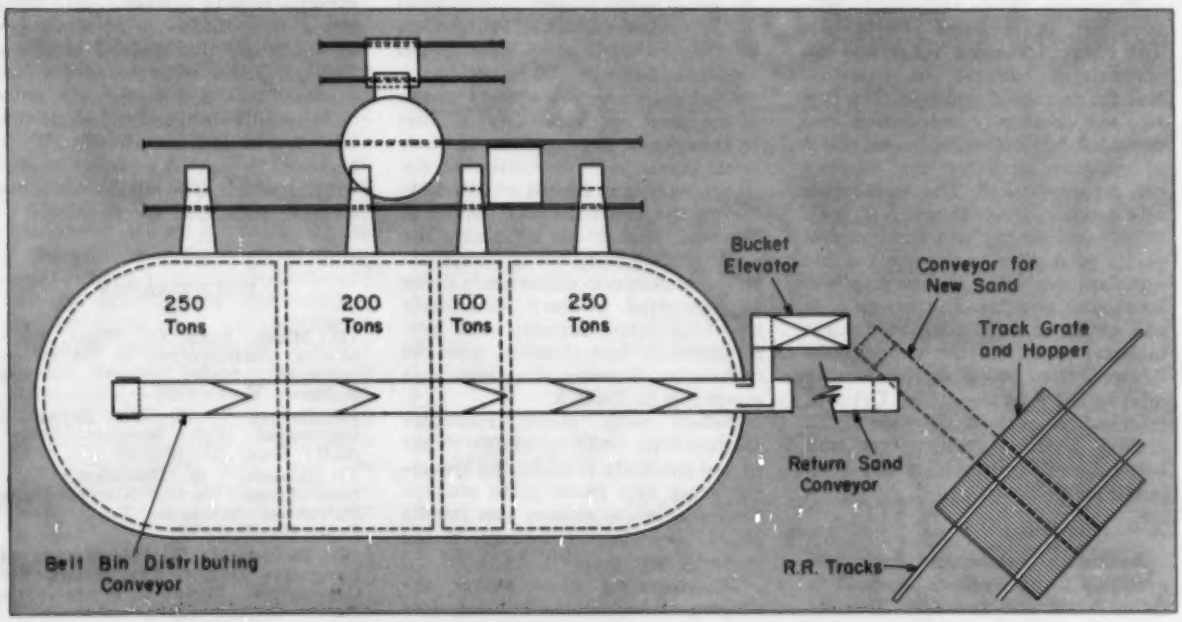
Bucket elevator (foreground) takes sand from underground belt conveyor and carries it to top of silo.

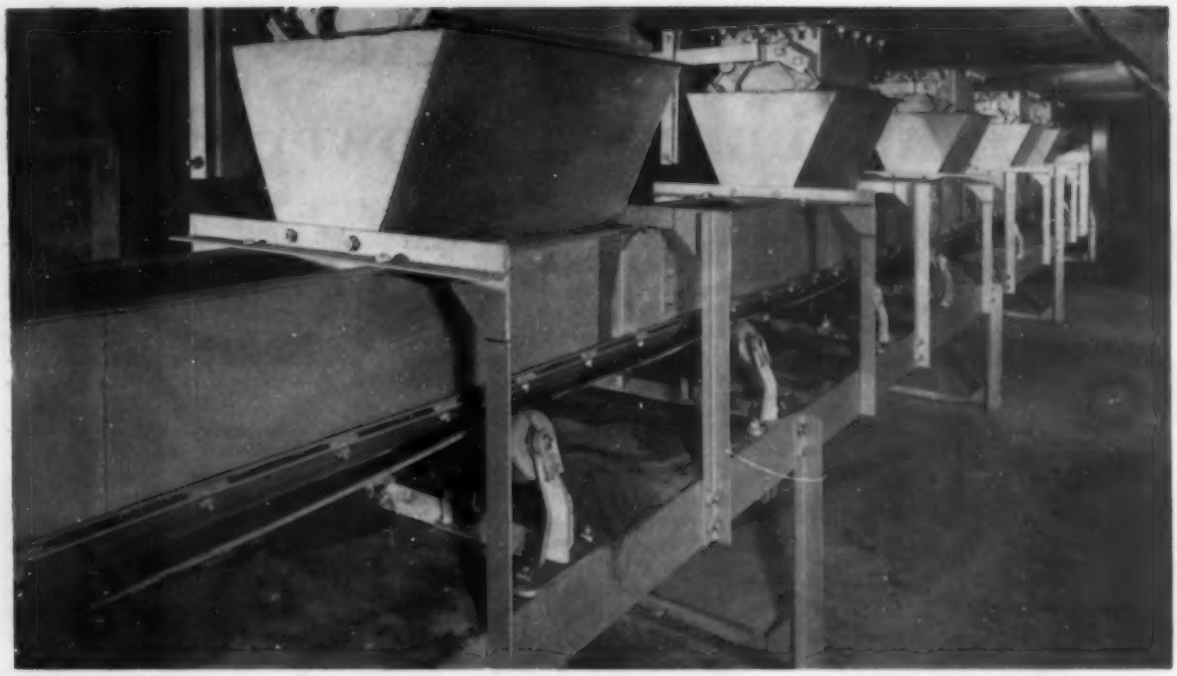


A rear view of the silo. Note the glazed tile construction and the totally enclosed conveyor systems.

Silo For Handling Sand i

The silo at the Allyne Ryan Foundry in Cleveland is strategically located between the foundry and the railroad siding to facilitate the handling and storage of sand shipments. All handling operations have been mechanized by conveyors.





The return sand conveyor is used to draw sand from the bottom of the main compartments and return it, via the bucket elevator, to the compartment pockets. This insures keeping the pockets filled between arrivals of sand shipments.

in Storage

AN 800 TON STORAGE SILO was designed and constructed as part of the sand preparation, storage, and handling system for the Allyne Ryan Foundry in Cleveland. The primary advantage of the silo is that it makes it possible for the foundry to purchase sand at a quantity rate during the summer months and have it on hand during those months when the sand pits are frozen over. Also, along with the bulk handling equipment, it facilitates the mixing of different types of sand needed for the foundry core molds.

Handling Sand

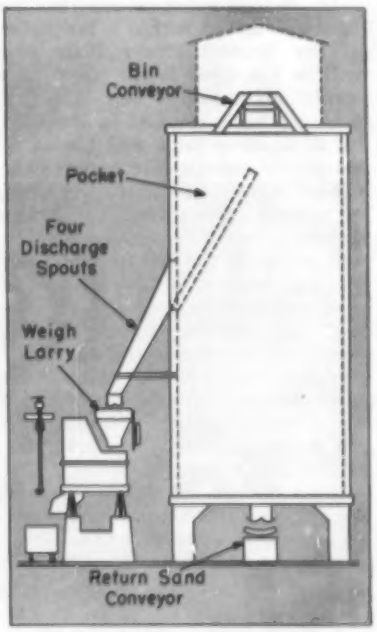
When the sand arrives at the railroad siding it is dumped into a track grate and hopper and carried by belt conveyor to a bucket elevator at the foot of the silo. The bucket elevator lifts the sand almost 66 ft to the top of the silo where it is then dumped onto a 20 in. wide by 40 ft long belt bin conveyor.

Since four different types of sand are used in this foundry operation, the silo is divided into four sections —the two outer ones with capacities of 250 tons and the inside sections 100 and 200 tons. These compartments are further subdivided, each having a small upper pocket of 10 to 35 tons. Sand from the belt bin conveyor falls directly into the small upper pocket. When the pocket is full, the overflow falls into the main compartment. Each pocket is used to serve the immediate needs of the foundry. The main compartment in each case represents dead storage.

Should the pockets empty at a rate faster than the rate of arrival of new sand shipments, sand can be gravity fed from the bottom of the main compartment to a return sand belt conveyor and carried to the bucket elevator. From the bucket elevator it follows the original path of the sand. In this manner the compartment pockets are kept filled.

The spouts from the pockets deliver sand to a 1500 lb capacity weigh larry. The larry is used to weigh out the required amounts of the different sands needed to make up the core mixture. This mixture is then conveyed by monorail to the foundry core room.

The silos are of vitrified glazed tile construction, designed and manufactured by the Kalamazoo Tank and Silo Co. They offer the advantages of simple construction, minimum maintenance, excellent weather protection, good insulation, and a neat appearance.



Drawing of the silo showing various components and their location.

Lignite Used as Fuel At New Aluminum Co. Power Plant

THE FIRST of three boiler and turbo-generating units (80,000 kw each) of the Sandow Power Plant at Rockdale, Texas, is now undergoing test runs using dried lignite as a fuel. The power plant was built by Texas Power and Light Co. and will be operated by Industrial Generating Company, a firm set up by TP&L for that purpose. The process for drying the lignite used as fuel was developed by the Bureau of Mines in cooperation with the Texas utility.

Very little information relative to this operation has been released by Aluminum Company of America, owners of the project, but at the Annual Meeting of the American Institute of Chemical Engineers, in St. Louis, in December, Dr. V. F. Parry, of the Bureau of Mines, presented a paper which gives an excellent idea of the design of the equipment being used to dry the lignite as well as some data on a proposed system for carbonizing lignite to produce char and a tar by-product. However, it will be some time before the first experimental carbonizer unit will be ready to extract tars from the lignite.

Dr. Parry's paper reveals that the lignite is mined within a few miles of the Sandow Power Plant and will be conveyed to the plant on a continuous conveyor belt. The 6 x 0-in. lignite is crushed to about ¼ in. in hammer mills and placed in temporary storage in concrete silos. Closed circuit pneumatic handling equipment carries this raw lignite to the dryers. Two dryers will be able to handle the fuel requirements for each of the 80,000-kw units.

In 1952, a 40-ton, prototype drying unit was installed at Rockdale and operated for several months as an experimental and test unit. These tests showed that this type of unit could be successfully operated with automatic controls. The units installed in the Sandow Power Plant have a nominal rating of 50 tons per hour when lignite containing 36 percent is dried to a final moisture content of about 4 percent.

Drier Design

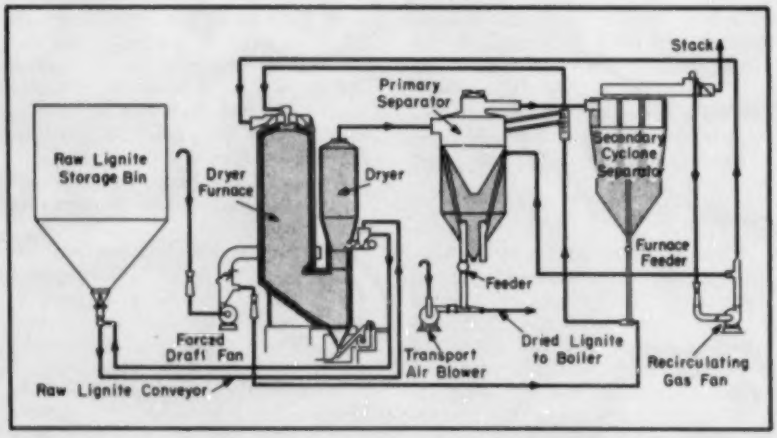
A small hopper above the screw feed in the dryer (see illustration) receives coal from the pneumatic conveyor leading from the silos. As this wet lignite enters the dryer, it is suspended in the drying column in a turbulent state by the products of combustion produced by the burning of dry lignite dusts with air and recirculated gases. This fuel supply is regulated to produce a temperature of about 300 F at the exit of the drying section, when the stack temperature is 275 F. Dr. Parry states that about 94 percent of the dried dust settles out in the primary separator, and the balance is separated in the secondary cyclone separator. Fine dust is returned to the furnace to be burned in the manner described. The dried lignite from the primary separator is pneumatically conveyed to the boiler plant for burning in the boilers. These steam generating units are Combustion Engineering, tangentially-fired, slagging-type boilers having a rating of over 800,000 lb of steam per hr. They are designed to operate at 1550 psig at a temperature of 1005 F at the superheater outlet. The guaranteed heat rate on the boilers and turbines is 9724 gross Btu per gross kwh at full capacity. The drying equipment was designed on the basis of 10,000 gross Btu per gross kwh.

Perhaps the most interesting aspect of this plant is that the design contemplates the burning of carbonized lignite. In the carbonizing process the lignite would be dried and then separated in the carbonizer into char and tar. The char would be burned in the steam generators while the tar would be a valuable by-product of the process. The value of the tar could be credited to the cost of the fuel. Dr. Parry points out that lignite might be produced for 10 cents per million Btu, but the tar derived from it might have a value ranging from 65 cents to $1 per million Btu. The value of the by-product would have to be great enough to more than cover the carbonizing costs if a profit were to be realized from the process. Actually, the value of the tar has not yet been established, as only small amounts have so far been available for sale.

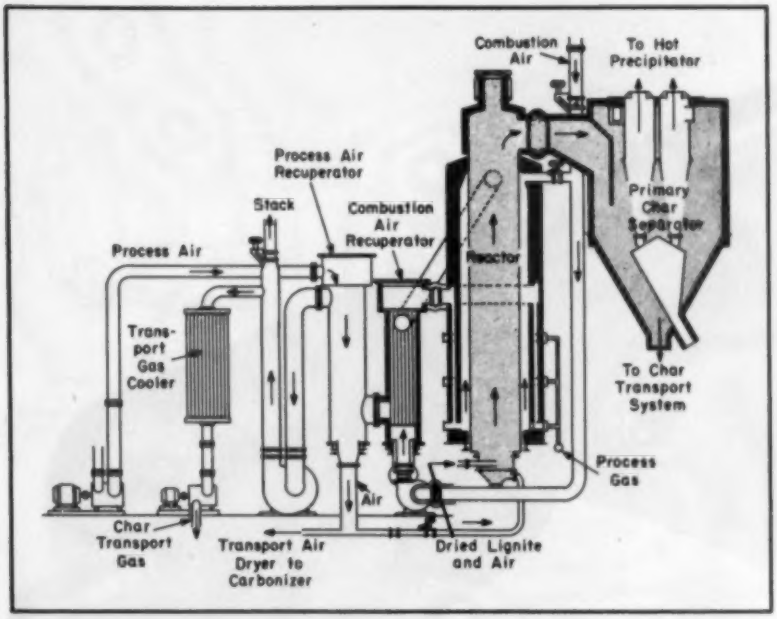
Carbonizer Design

Three dryers and three carbonizers will be required to supply each 80,000-kw unit, as compared to two dryers per unit when burning dried but uncarbonized lignite. The carbonizer reactor is of alloy steel, 6 ft in diameter and 35 ft high. This reactor is mounted in a special furnace. Dr. Parry describes the equipment in this way:

"The process air is compressed to



This flow diagram shows the equipment now being used at the Sandow Power Plant in Rockdale, Texas, to dry lignite which is burned in the plant boilers.



Schematic diagram of carbonizer proposed for us at the Sandow plant. This process would extract tar from lignite leaving a burnable char for use as fuel.

about 8 psig and passed through a recuperator where it is preheated to about 700 F. Part of the preheated air is diverted back to the dryer and picks up the dried lignite for transport to the reactor, and part of the air goes directly to the base of the reactor. The mixture of air and coal enters the base of the reactor, and the fine coal is moved upward through the reactor, entrained in the products of reaction in a turbulent condition. The solids are not in a true fluidized state because of the high superficial velocity of 6 to 8 fps. The temperature of the products leaving the top of the reactor is controlled automatically by regulation of the combustion around the reactor or by regulation of the air-coal ratio.

"The developed temperature around the reactor is controlled to less than 1900 F to protect the heat-resisting alloy . . . The volume and heating surface of the reactor have been selected to permit carbonization of the coal at the rate of about 60 lb per hr per cu ft when the velocity is 6 to 8 ft per sec."

The char is collected in separators and pneumatically transported to 150 ton bins mounted on the boiler structures. From these bins the carbonized lignite goes to the burners.

Extracted tars go from the char separator to a hot precipitator.

It should be remembered that this whole carbonizing process is in the experimental stage, and experience from this operation will indicate whether the installation of a complete carbonizing plant would be an economically feasable undertaking. Meanwhile, the boilers will be operated on dried lignite.

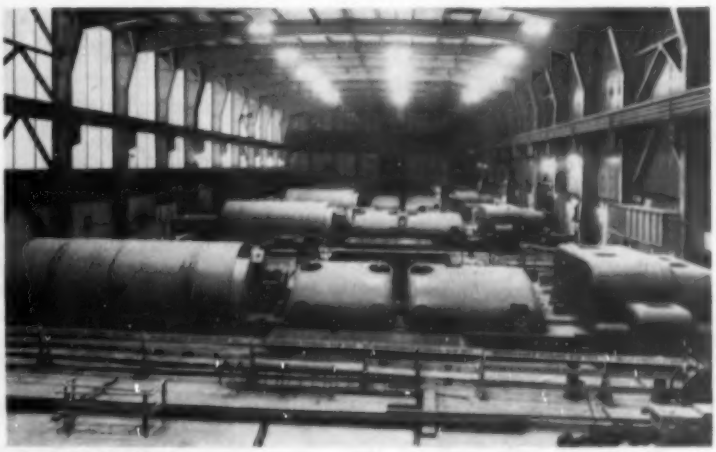
Four Units on Line at Shawnee

THE FIRST FOUR units of TVA's Shawnee Steam Station are on the line and generating while construction work on the six remaining units progresses. Units 1 through 4 are operating satisfactorily while the final flooring, pit guard rails, and control room decorating is being installed.

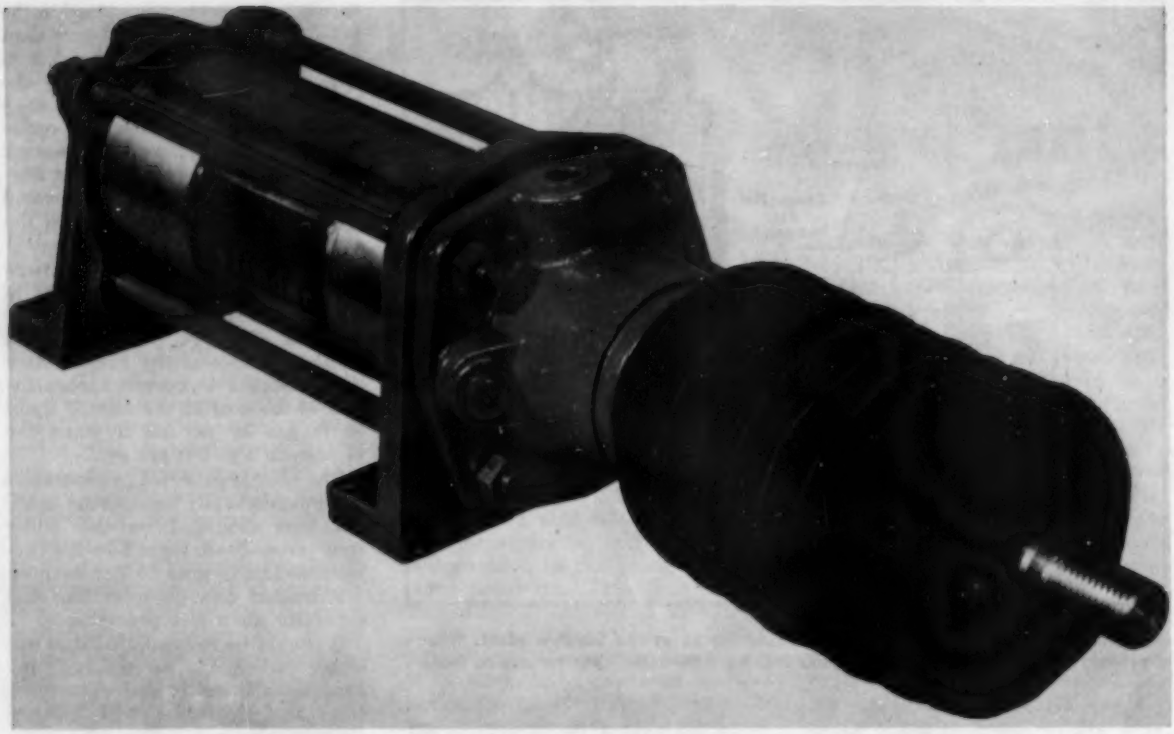
Most of the structural steel work for the turbine-generator room is in place. Bed plates for Number 5 unit are installed. A temporary wall separates that portion of the bay under construction from the Units 1 through 4.

The station control rooms each handle two units and each control room has a huge glassed-in bay window, which is centered on the aisle between the units being monitored.

Each of the boilers is rated 1 million pounds of steam per hour at 88.33 percent efficiency. The turbines are each rated 135,000 kw with a maximum of 150,000 kw. The generators each put out a rated 135,000 kw at 0.9 power factor, 0.5 psig hydrogen, 18,000 volts, and 3600 rpm. Ultimate capability on each generator is 168,539 kva or 150,000 kw at 0.89 power factor and 15.0 psig hydrogen. They will feed the TVA network through step-up transformers at 161 kv.



Looking down the turbine-generator bay. Control room bay windows are at right between units; far wall temporarily shuts off uncompleted areas.



A bellows type boot offers simple but effective protection against abrasive matter contacting the piston rod surfaces.

Protective Boots for Machinery

Whenever there's possibility of abrasive matter coming in contact with piston rods or other highly finished moving machine part surfaces, a protective boot is a good idea.

JOHN E. HYLER

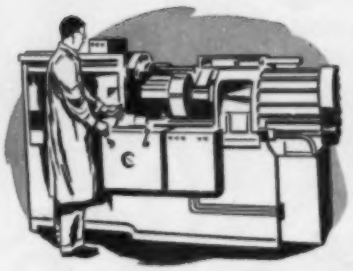
PROTECTIVE BOOTS OR SLEEVES are often a desirable accessory for moving machine parts that are made to close tolerances or have highly finished surfaces and that are in locations where they are exposed to moisture, abrasive dust, grit, sand, or corrosive atmospheres.

Most mechanical boots are of the bellows type and are designed to fit closely around both ends of the moving machine member. This type of boot is particularly applicable wherever universal or eccentric action makes a rigid seal impractical. The bellows allow the boot to expand or contract along with the movement of the part, while at the same time maintaining a tight seal against foreign elements that could damage the part or contaminate the lubricant.

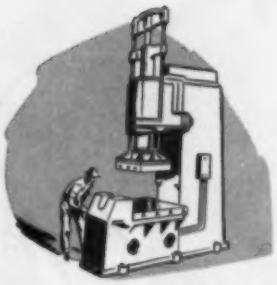
One of the most common applications for protective machinery boots is on the air and hydraulic cylinder piston rods that are found on types of equipment ranging from furnace and oven doors to valves and hoists. In foundries, forge shops, cement plants, and where the pistons are exposed to the weather, past experience and practice indicate the feasibility of protecting the finished surfaces from the excess wear and damage that can be caused by dirt, dust, and corrosive elements.

Boots can be made from materials such as rubber, canvas, or even light sheet metal. Installation is quite simple and generally speaking there is a minimum of maintenance. One disadvantage of the boot is that while it shields the moving machine member from foreign matter it also prevents the operator from making visible checks of the operation, wear, and lubrication of the hidden part.

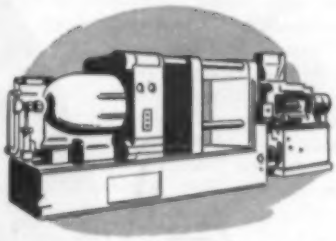
The different leading manufacturers of hydraulic and air cylinders and allied equipment usually recommend (and are in a position to provide) protective boots for use on the piston rods of any of their power cylinders.



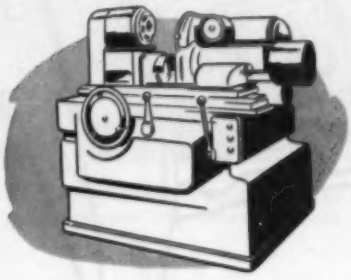
For hydraulic systems on all types of injection molding machinery.



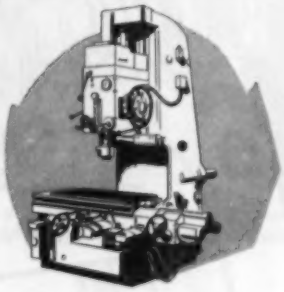
For hydraulic systems on all types of presses and forging hammers.



For hydraulic systems on all types of plastics molding equipment.



For hydraulic systems on grinding machines and other production tools.



For hydraulic systems on jig borers and other metalworking machinery.

For hydraulic systems on standard and special heavy-duty forming presses.

For Every System, a Sun Hydraulic Oil to Give Top Performance and Economy

Sun makes a variety of hydraulic oils, because *no single oil will meet all combinations of conditions economically*. Among the many hydraulic oils made by Sun the following cost-cutting products are typical.

SUNTAC OILS. Designed to cut leakage. They reduce it an average of 35%—and results are immediate. But they wouldn't be economical in a tight system.

SUNVIS H.D. 700 OILS. Clean dirty systems in 50 hours or less without loss of production. But they wouldn't be economical in systems that leak badly.

NEW SOLNUS OILS. Resist oxidation, prevent rusting and corrosion. They are low in cost and have long service life. But they wouldn't be economical in systems where excessive contamination is a problem.

Among the many different hydraulic oils made by Sun, there's one that's best for your system—a hydraulic oil that will give top performance at lowest possible cost. Consult your local Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. IP-4.

INDUSTRIAL PRODUCTS DEPARTMENT

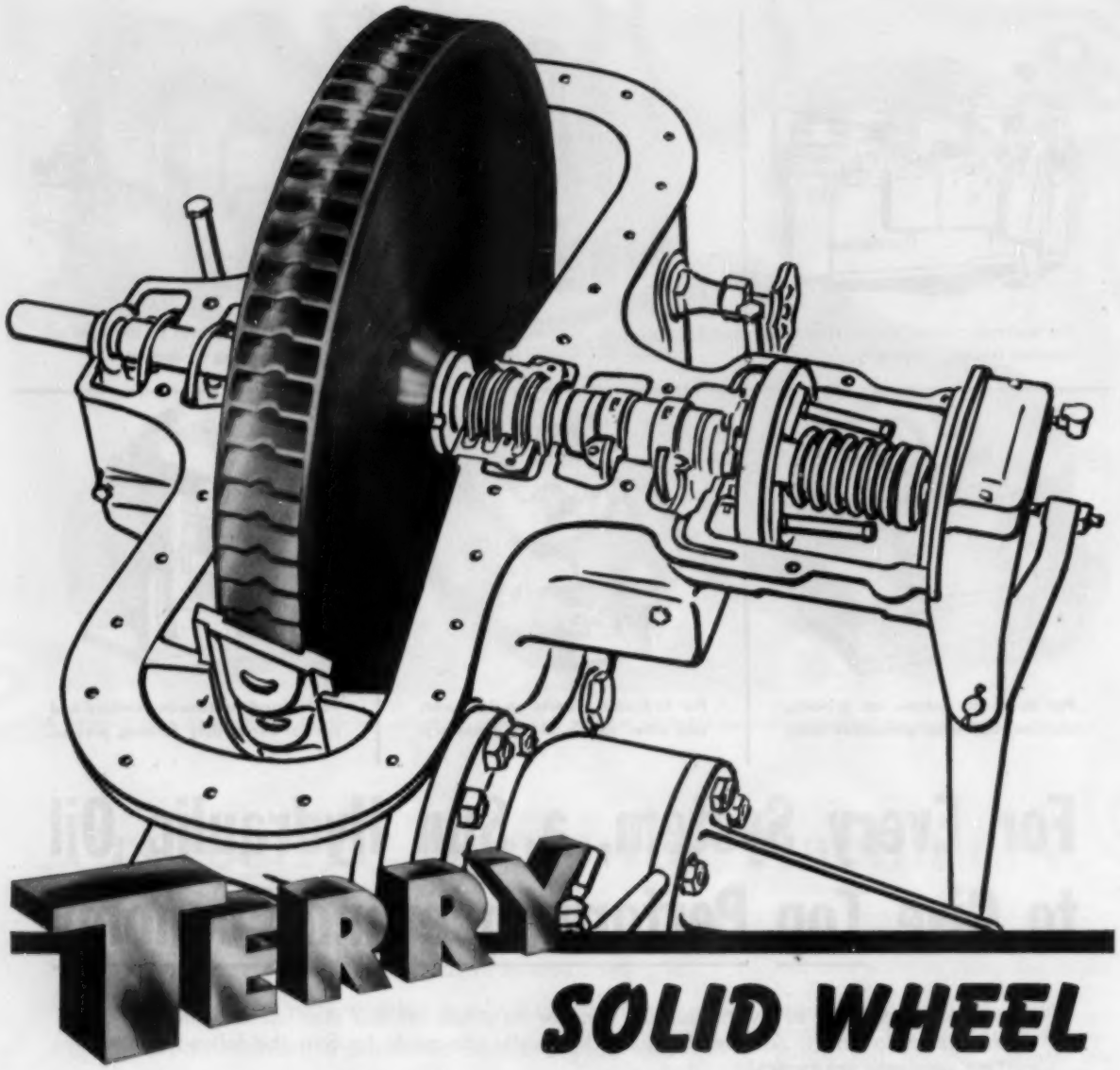
SUN OIL COMPANY

SUNOCO

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of the famous Blue Sunoco Gasoline and Dynalube Motor Oils

Circle 539 on Reply Card for more data



SOLID WHEEL RUGGEDNESS

is your turbine dividend

The rugged construction and fool-proof design of a Terry solid-wheel turbine can save you money by keeping maintenance costs to a minimum. Usually only taken down for routine inspection, any repairs that must be made are of relatively simple nature, and cost of replacement parts is small.

The rotor of the turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to loosen or work out. As the only function of the blades is to form a series of pockets, any wear which might occur would not materially affect horsepower or efficiency.

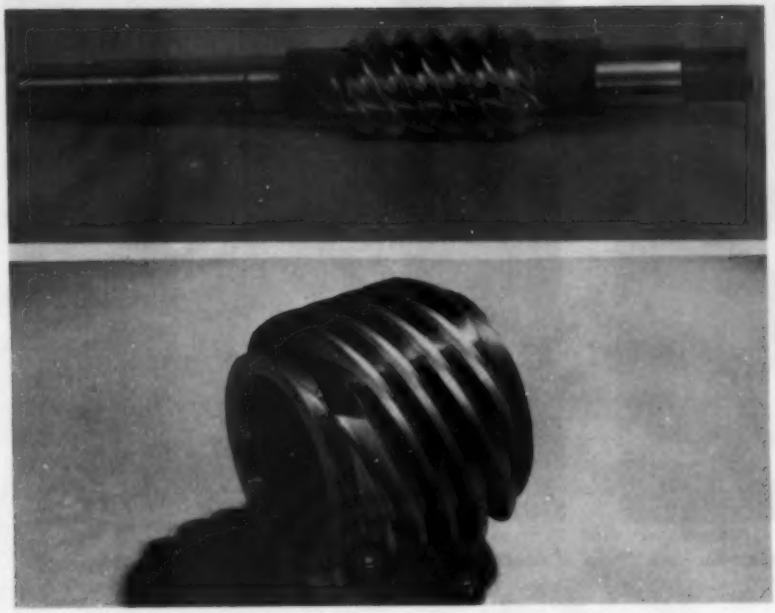
It is impossible for the blades to foul. They have large clearances and are further protected by the projecting rims of the sides of the wheel. As the side clearances are also very large, end play can do no harm.

The Terry solid-wheel turbine is an extremely reliable piece of equipment—why not write for complete details today? Ask for a copy of Bulletin S-116.

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONN.

TT-1198

Circle 540 on Reply Card for more data



Comparing sizes of a shell worm and an integral worm having the same speed reduction ratio and center distances. The integral type has some advantages.

Guide for Selection of Worm Gearing

JAMES E. GUTZWILLER, Asst. Chief Engr.
Standard Products Division
DeLaval Steam Turbine Co.

WORM GEARING, in addition to its widespread usage in the form of enclosed speed reducers, is employed as an integral part of many types of machines. One of the most unusual features of worm gearing is that the pitch diameters of the worm and gear are not proportional to the reduction ratio. A single compact set of gearing can provide a large reduction in speed, avoiding the need for a multiplicity of gearing members and bearings. Ratios between 3:1 and 100:1 are practical for power transmission and even higher ratios are employed for indexing and positioning devices.

Materials selected for the worm and gear are governed by the nature of the gear tooth contact. The meshing of the worm threads and gear teeth is a combination of sliding and rolling action with the sliding action becoming dominant at the higher ratios. Therefore, dissimilar materials are normally selected for the two gearing members, with the worm, which experiences the larger number of contact cycles, made of the harder material. The higher the rubbing velocity, the more critical is the need for materials which operate with the required good frictional or bearing properties.

The worm is usually made of steel and heat-treated after the worm threads are rough formed. Case hardening is the process most commonly used to obtain the surface hardness desirable for wear resistance. Many types of materials are used for the gears, but bronze predominates. For very slow speeds, where bearing properties are not such an important factor, cast iron and hard bronzes, such as aluminum and manganese bronzes, may be used. However, for general application over a wide range of speeds, experience indicates the best combination of materials is an alloy steel worm, case-hardened and thread ground, mating with a chill cast nickel-tin-bronze gear.

Rating Standards

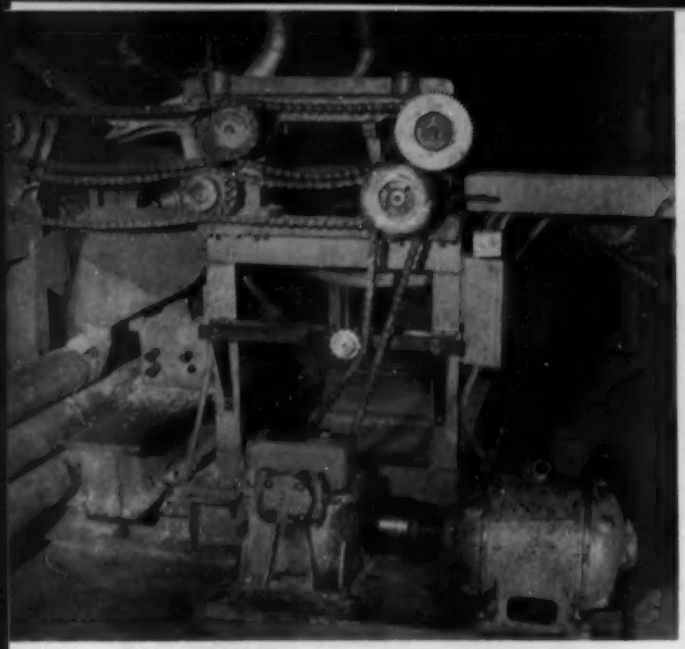
The establishing of comparative power capacities for worms and gears of various material combinations has been slow in developing. Some data relating to this subject has been published, but this lacks sufficient verification by test and application to be of much value. Establishing of load carrying capacities for various grades of cast iron, for example, has been very difficult as these materials are not consistent in performance.

The American Gear Manufacturers Association has established ratings for the class of gearing generally employed in worm gear speed reducers. These ratings (AGMA standard 213.02 Surface Durability of Cylindrical Worm Gearing) apply to gearing incorporating an alloy steel worm, case-hardened and thread ground, and a gear of chill cast nickel-tin-bronze. The determination of ratings for this type of gearing was practical in view of the many years of experience.

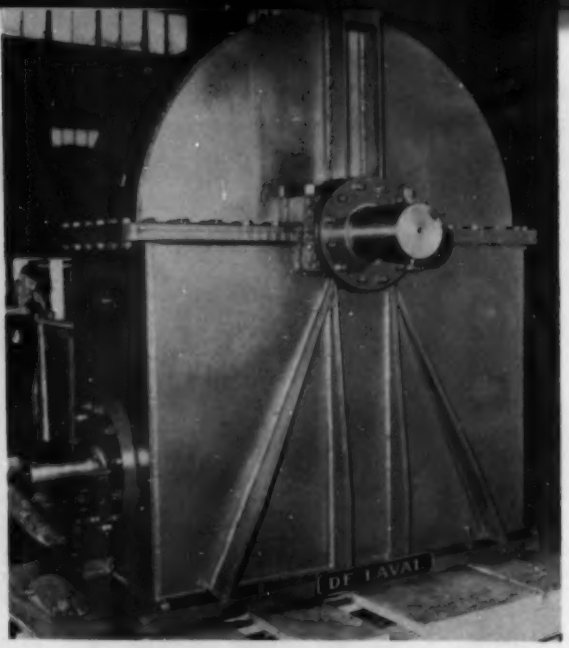
This rating standard recognizes five distinct classifications of service based on the nature and duration of loading. The basic rating is intended for use under service conditions of 8 to 10 hours a day operation with no recurrent shock loads. Service factors, for either increasing or decreasing the basic ratings, can be applied.

Design Considerations

Worms may be formed integrally with their shafts or bored and assembled on their shafts. The latter type is commonly known as a "shell worm". Practical limitations make the "shell worm" a necessity on some applications. For example, gearing used to drive oil pumps or governors from a turbine shaft normally incorporate "shell worms". The bore of this type of worm must be made of sufficient size to accommodate a shaft of the required stiffness, and as a consequence, the worm diameters are usually abnormally large in comparison to those of the integral type. Increased diameter results in a decreased lead angle and higher rubbing velocity which results in a lower efficiency and load carrying



A worm gear transmission with a high speed rotary saw.



Giant worm gear with a speed reduction of 26⅔ to 1.

capacity. For these reasons the integral type worm is preferred.

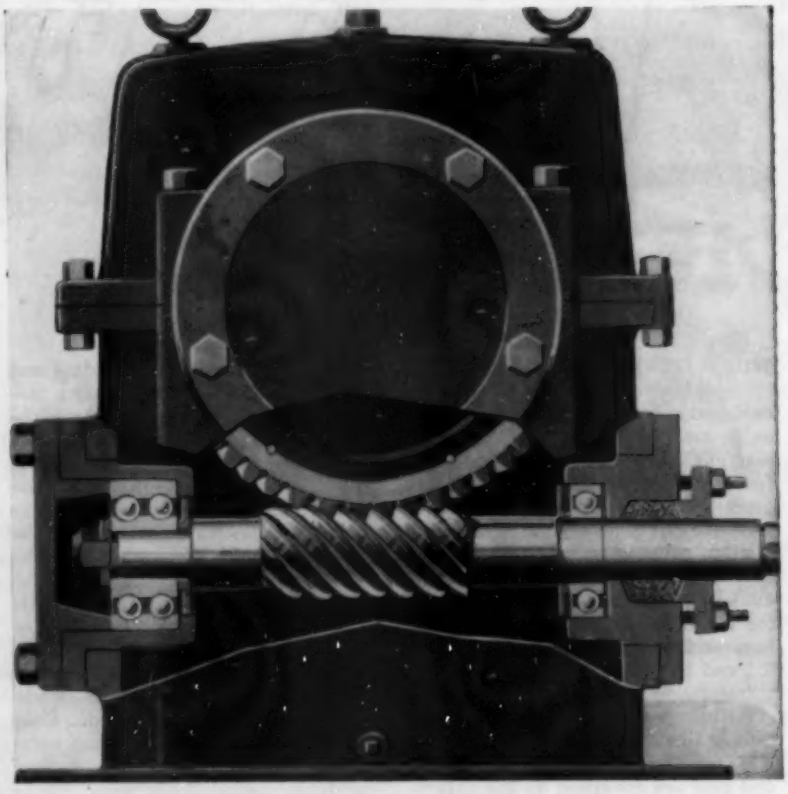
The hob to be used for cutting the gear is one of the most important factors to be considered in designing a worm and gear, as the hob must be of essentially the same form as the worm. In order to avoid the expense and delays which go with the procuring of a special hob, it is wise to base the design of the worm on an existing hob. If the gearing is to be purchased, the supplier should be consulted prior to final design as tooling will normally be available for producing gearing which will meet the basic requirements.

Bearings and Supports

After preliminary selection of gearing has been made, thought must be given to its arrangement and support. In order to determine the requirements for bearings, the gearing forces must be calculated and resolved into bearing loads.

Final selection of bearings is affected by speed, combination of forces, arrangement of bearings, and ease of assembly. The worm is subjected to a large component of thrust which must be accommodated by an adequate thrust bearing. During the period after the start of operation when the temperatures of the lubricant, gearing and casing rise, expansion of the worm and casing may occur at different rates. This factor must be considered in selecting and supporting bearings to prevent excessive loading.

Angular contact ball bearings or tapered roller bearings may be used for short worm spans (up to eight or nine inches). Bearings at one end of the worm are designed for carrying combined radial and thrust loads and can consist of either a pair of duplex ball bearings or a pair of tapered roller bearings. The radial bearing can be either a ball bearing or cylindrical roller type arranged so that endwise expansion of the worm can be accommodated. For a ball bear-



A cutaway view of a commonly employed horizontal worm and gear speed reducer.

ing this may be accomplished by avoiding any restriction of the endwise movement of the bearing in the housing. Cylindrical roller bearings may be selected which permit this movement within the bearing itself.

Tapered roller bearings are most commonly used for the support of the gear shaft although almost all types are in use for this purpose. Considering the slow speeds involved and the design of these bearings, they can generally be mounted opposed for this application with little concern regarding differential expansion. Support of the gear shaft may also be accomplished by sleeve bearings. Generally, these sleeve bearings are of bronze material and are flanged to provide thrust faces against which hardened steel washers bear.

Use of precision bearings may be dictated by any one of several considerations. Close tolerances on shaft runout or smoothness of motion transmission, such as are often encountered in machine tool work, may indicate their need. If the gearing is to operate with a minimum amount of backlash, precision bearings may be required to prevent alternate binding and looseness. Similarly, an excessive runout of gears, caused by the bearings, adversely affects the accuracy of tooth meshing and results in noise and excessive wear when high speeds are involved.

In designing bearing supports, the first consideration is to provide a sturdy means of location to prevent excessive deflections under load. Other factors of major importance are bearing adjustment and ease of assembly for bearings and gearing.

Adjustment of Gearing

Provision for adjustment of the gearing at assembly is an important factor which many times is completely overlooked. The worm, having threads which are continuous in form, is not critical in regard to endwise location. The gear, however, must be precisely positioned axially. Accumulation of tolerances on the dimensions of housings, shafts, bearings and gears usually makes it impractical to control the location of the gear by accuracy of machining alone. As a consequence, the correct positioning is normally accomplished by the shimming of the gear at assembly or the machining of parts to suit. Machining has the disadvantage of losing the benefits of interchangeability, thereby complicating the work required in replacing parts.

Provision may also be required for the adjusting of bearings. For this purpose, the same methods of shimming or remachining parts to suit may be used. Where bearings such as tapered roller type are mounted at either end of a gear shaft, shims may be used for the dual purpose of bearing and gearing adjustment.

The gear housing acts as an enclosure to retain lubricant and exclude dirt and moisture. It also acts as a bearing support and a means of heat dissipation. In the most common form of lubrication system, oil contained within the housing is directed by splash to gear mesh and bearings. Natural splash may be augmented by the aid of flingers, scrapers, and cups attached to the gear. Channels or ribs may also be used to direct oil to bearings. In view of thermal considerations, close shrouding of gearing by casing should be used only if operation is intermittent. Where service is continuous and speed is high, ample space around the gearing should be provided to avoid the generation of excessive heat by oil churning and to provide adequate surface for heat dissipation.

Tabulated below are the recommended splash lubricant levels:

¶ Worm below gear — Level at center of worm

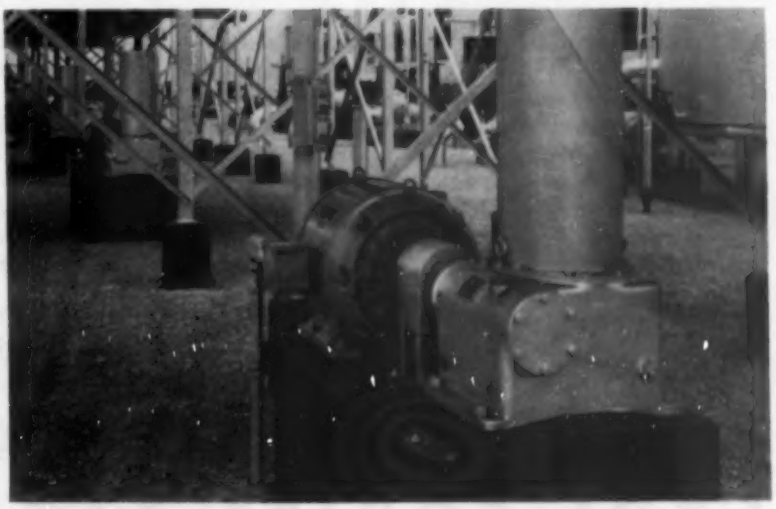
¶ Worm above gear—Level at 1/6 of gear diameter

¶ Worm beside gear — Level at center of worm and gear

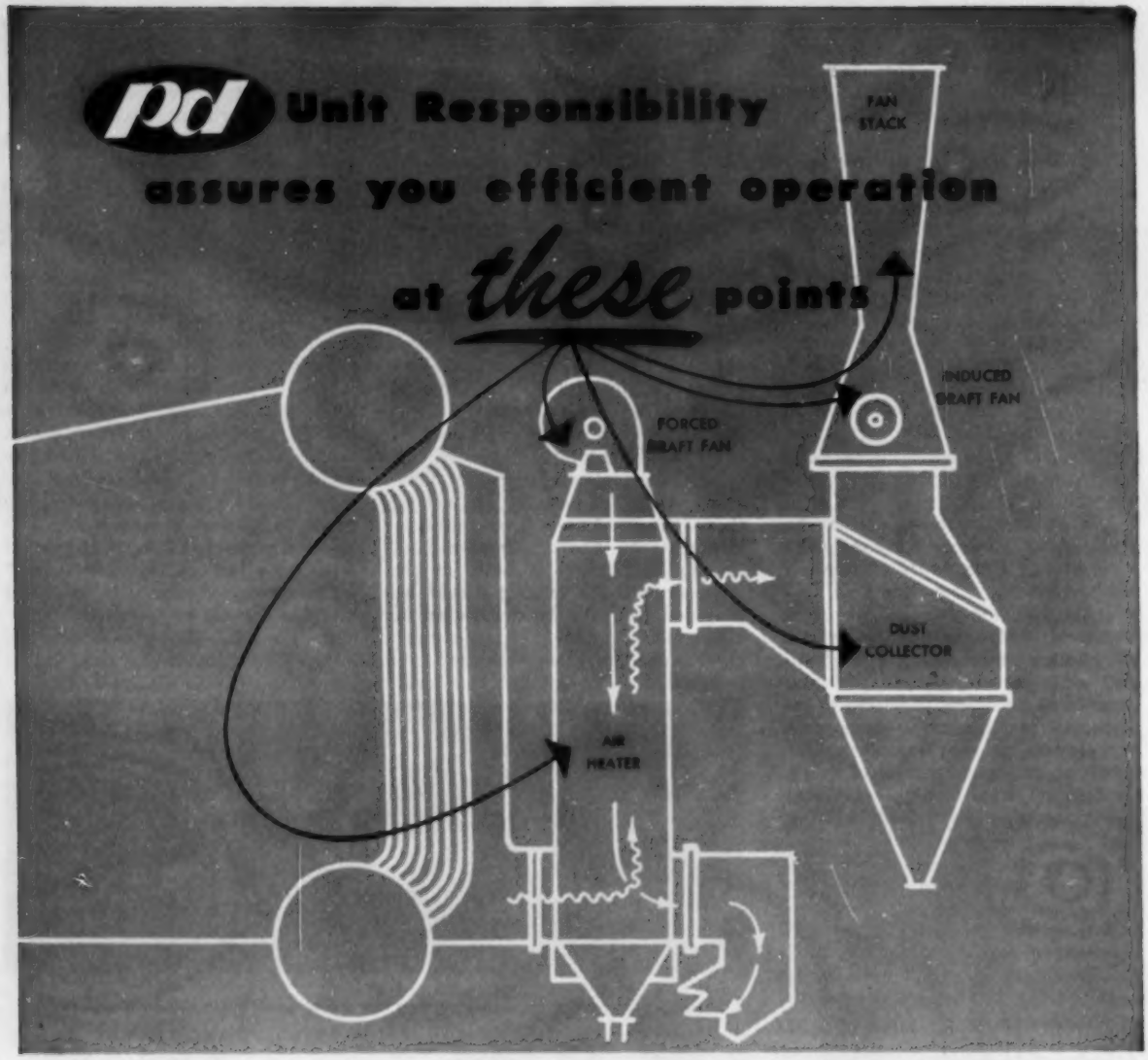
Adjustment of these levels upward or downward may be advisable where conditions of either very low speed or high speed are encountered.

Pressure lubrication is advisable where speeds are high in order to avoid excessive oil churning. This system also provides a convenient means of cooling by permitting the inclusion of an oil cooler in the piping system when required. The pressure lubrication system may also be used to supply oil to other parts of a machine, but careful thought must be given to selection of a lubricant suitable for all components.

Selecting a standard hob for cutting the worm gear saves expense and delay.



Vertical worm gear speed reducers installed for cooling tower service.



Unit Responsibility, for important components of plant design by the Prat-Daniel Corporation, relieves your engineers of necessary problems of coordination that often arise when equipment is purchased from several sources.

Prat-Daniel, designing and manufacturing engineers of *Forced Draft Fans*, *Air Preheaters*, *Tubular Dust Collectors*, *Induced Draft Fans* and *Fan Stacks*, make possible this coordination of components by a single company with over a quarter of a century experience in the power field.

This service is offered through The Thermix Corporation, project engineers for Prat-Daniel. Specialists in this field, they can assure you a completely integrated system. Why not contact Thermix today. Ask for the new P-D Bulletin 4P201.

Project Engineers for Power Plant Division

THE THERMIX CORPORATION

GREENWICH, CONN.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Quebec; Toronto 5, Ontario

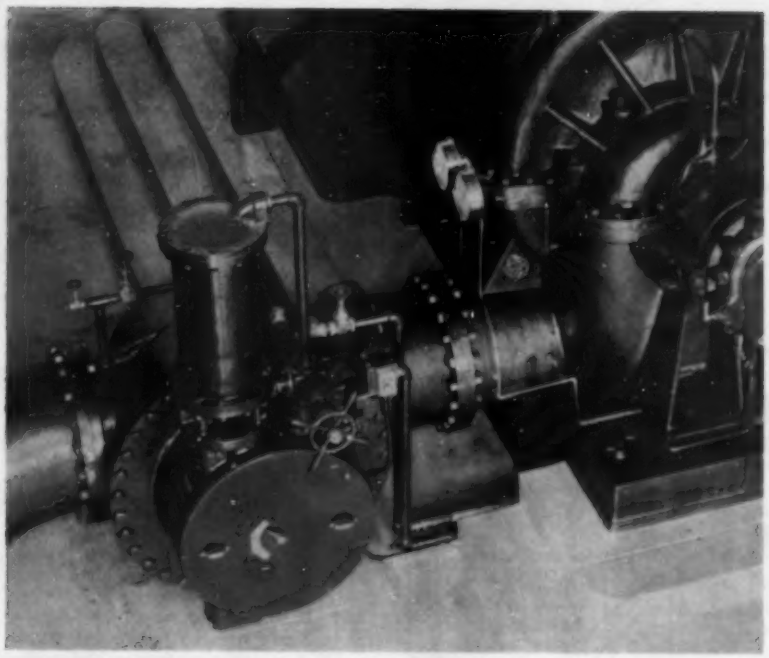
Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks.

Circle 541 on Reply Card for more data



To prevent excessive water hammer, many pump installations use hydraulic operated check valves whose opening and closing time can be regulated.

Centrifugal Pump Controls

IGOR J. KARASSIK and ROY CARTER
Worthington Corp.

THE CENTRIFUGAL PUMP is one of the simplest types to control as compared to reciprocating or rotary pumps. It owes this ease of control to the flexibility of its characteristics and to its adaptability to the different systems.

Fundamental Functions

The fundamental functions of centrifugal pump controls are directed towards permitting the pump to meet the required variations in operating conditions, including the complete absence of delivery.

Centrifugal pump controls may be subdivided into two main groups with respect to their function:

¶ Controls which cause complete interruption or resumption of flow;

¶ Controls which vary the operating conditions, that is, either the pump capacity or the total head or both conditions.

It may become necessary to stop delivery if:

¶ The supply source has been drained to the desired level;

¶ The vessel into which delivery is made has been filled to the desired level;

¶ The pressure of the system into which the pump is delivering has reached its required magnitude;

¶ A batch process served by the pump has been completed;

¶ A system is served by a battery of several pumps operating in parallel and the required rate of flow has decreased to a point where one or more of the pumps could cease to deliver. This permits the remaining pumps to operate at a more economical point on their characteristic curve;

¶ Mechanical trouble has occurred in the pump, its driver, or in some part of the system.

Types of Interruption Controls

Controls which cause interruption or resumption of flow can be subdivided into two separate classes:

¶ Start or stop of the driver;

¶ Opening or closing of a valve in the path of flow.

Drivers can be started or stopped by means of:

¶ *Push-button controls* for electric motors.

¶ *Float or tank switches* which may be applied to maintain predetermined maximum or minimum levels in tanks or reservoirs into which fluid is discharged by electric motor driven centrifugal pumps.

¶ *Pressure switches* are similar in principle to the float switch but operate on changes of pressure and are used to maintain pressure in a system or in a closed tank within certain selected limits. The pressure to be controlled is generally applied to a diaphragm actuating the switch.

¶ *Power consumption controls* may be directed to stop the unit when the driver has been overloaded.

¶ *Thermostat controls* are for centrifugal pump applications, especially in process industries, where certain definite temperatures are to be maintained or reached by means of heat transfer or recirculation.

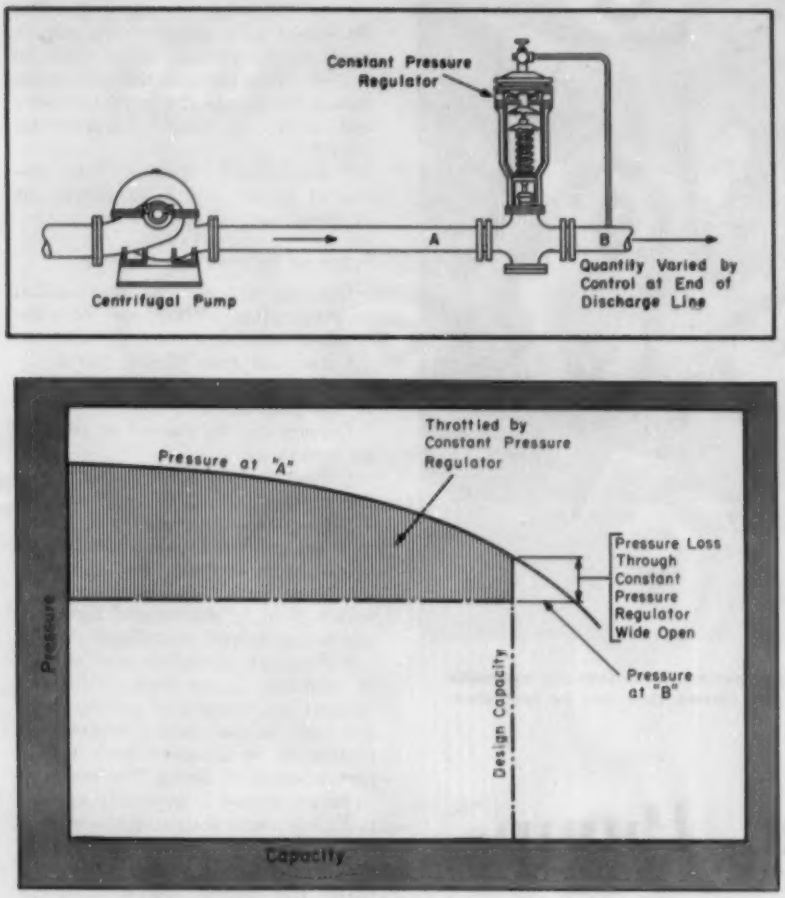
¶ *Overspeed governor controls* are applied mainly to steam turbine drivers although they can also control internal combustion engines or even water turbines used to drive centrifugal pumps.

Interruption Without Stopping Unit

Flow can be resumed or interrupted through valve positioning without affecting driver operation by means of:

¶ *Manual control of discharge valves.* A gate, globe, or plug valve, located in the pump discharge can be used to cut off the flow entirely through manual manipulation. This form of control requires the use of a by-pass to prevent overheating of the pump when operating at shut-off conditions.

¶ *Check valve in the discharge line.* Some form of check valve is almost always used in the discharge line from a centrifugal pump. It



Upper diagram—A typical constant pressure pump regulator installed in pump discharge; shows the relationship between measuring, impulse, relay, and power elements of control. Curve below indicates pump performance.

acts to protect the pump, its driver, and the suction portion of the system against damages which may be caused by reverse flow.

¶ *Float control valve.* The variation in suction or discharge levels can be transmitted to a mechanically or electrically operated valve in the pump discharge to basically perform the same function as a float switch.

¶ *Pressure control valve.* This form of control bears the same relation to the pressure switch that the float valve bears to the float switch.

¶ *Thermostat control valve.* Temperature variations are utilized to close or open discharge valves instead of operating on the driver itself.

The last three control applications are rarely used except where needed to perform the added function of modifying the pump operating conditions over a wide range. This wide range may include permitting the valve to travel to the full closed position. Whenever a valve positioning control may fully interrupt flow delivery, it is important that a bypass recirculation line be provided so that the pump does not operate against a closed discharge.

Variation of Operating Conditions

Since the operating conditions of a centrifugal pump are established by the intersection of the head-capacity curve at the operating speed and of the system head curve, it follows that variation of the operating conditions can be obtained by either one of two methods:

¶ Modification of the pump head-capacity curve;

¶ Modification of the system head curve as the second alternative.

Modification by Speed Variation

Modification of the head-capacity curve as the second alternative. of the pump speed either by modifying the speed of the pump driver itself or by applying a variable speed power transmission mechanism such as a hydraulic coupling or a magnetic power transmission.

Modification by Valve Positioning

In the majority of installations, however, it is either impossible or impractical to change the pump operating speed. In order to alter the operating conditions, it is necessary to alter the shape of the system head curve by varying the friction head loss in some part of the system. A throttling valve, used to vary pump capacity, will correspondingly change the shape of the system head curve, within its range.

Pump Control Elements

Pump controls can be logically separated into four individual functional parts:

Measuring element;
Impulse element;
Relay of the impulse;
Power element.

Fundamentally, all control problems in the operation of centrifugal pumps can be reduced to the problem of balancing flows, pressures, temperatures, or combinations of two or more of these. As a result, the measuring element must determine some force or forces set up in the pumping system which change in magnitude as the quantity to be controlled varies.

The impulse element is that portion of the control which does most of the thinking; deciding when the measured variable has reached a predetermined value or when it is properly balanced against some other variable with which it must remain in certain correlation.

The relay of the impulse may or may not exist as a mechanism, depending on whether this portion of the pump control is or is not automatic. If the function of the impulse element is to ring an alarm bell when certain conditions are detected by the measuring element, the function of the relay element will be accomplished when the operator walks over to a valve which the alarm has indicated must be throttled.

In the majority of control mechanisms, the function of the relay element is to transmit the decision reached by the impulse element to the power mechanism which actually operates the control. This function can be discharged in a wide variety of manners and can be performed mechanically, hydraulically, pneumatically, or electrically.

The power element performs a change in some relationship in the combination of pump and pumping system, such as a change in the valve setting, a reduction or in-

crease in the pump speed, or the stopping or starting of the pump. Again, the source of the power used in this element may be either mechanical, hydraulic, pneumatic, or electric.

While it has been assumed in the interest of simplicity that the four elements of a centrifugal pump control can be readily separated and analyzed individually, in practice it more frequently happens that the four elements and their function are closely interrelated.

Analyzing Control Methods

Some of the more important factors that indicate the general character of the analysis which must precede a choice between manual and automatic controls are:

¶ *Frequency of operation*—Is the control operation required infrequently, at frequent intervals, or constantly? The starting up of a standby pump on failure of the main pump, an operation which is apt to occur very rarely, is less in need of automatic controls than the maintenance of a constant pressure in the discharge header where variations in the flow delivery require constant re-positioning of the regulating valve.

¶ *Expectancy of operation*—Is the control operation to occur at regularly scheduled intervals, or is the requirement sudden and unexpected? For example, the starting up of additional boiler feed pumps in a power plant prior to an expected increase in load at certain times of the day can be carried out manually quite readily. On the other hand, the start-and-stop operation of a transfer pump which delivers into a storage tank depends wholly on the varying rate of usage from the tank and therefore cannot be accurately predicted.

¶ *Urgency of operation*—Must the controlled operation take place instantly upon the occurrence of certain conditions, or can it take place at leisure? Basically, the differentiation here is between corrective and protective controls. In the case of the latter, it is almost imperative that the measuring and impulse elements be automatic. However, certain corrective controls must operate almost instantly. Boiler feed pump controls, for example, are intended to maintain a constant level in high pressure boilers automatically.

¶ *Difficulty of operation*—Is the application of the control suitable for manual operation or are the forces required to set the control in motion excessive? Taking two extremes for an illustration, it is obvious that while a 1-in. valve can be readily throttled manually, the task of closing or opening a 24-in. valve can be made much simpler if it is provided with automatic electric drive or has a hydraulic operating cylinder.

¶ *Facility of detection*—Is the quantity to be measured subject to accurate determination by human senses or is it impossible to obtain sufficiently accurate measurements except by mechanical means?

¶ *Economics of personnel attendance*—Is an operator always available when needed or would the manual operation of the control require the addition of personnel otherwise not necessary?

Protective controls are, by their very nature, automatic in operation since they serve mainly to complement the operating personnel and perform functions which would normally be performed manually if the personnel were on hand. Likewise, the majority of these controls are intended to stop the pump and its driver whenever certain harmful operating conditions arise.

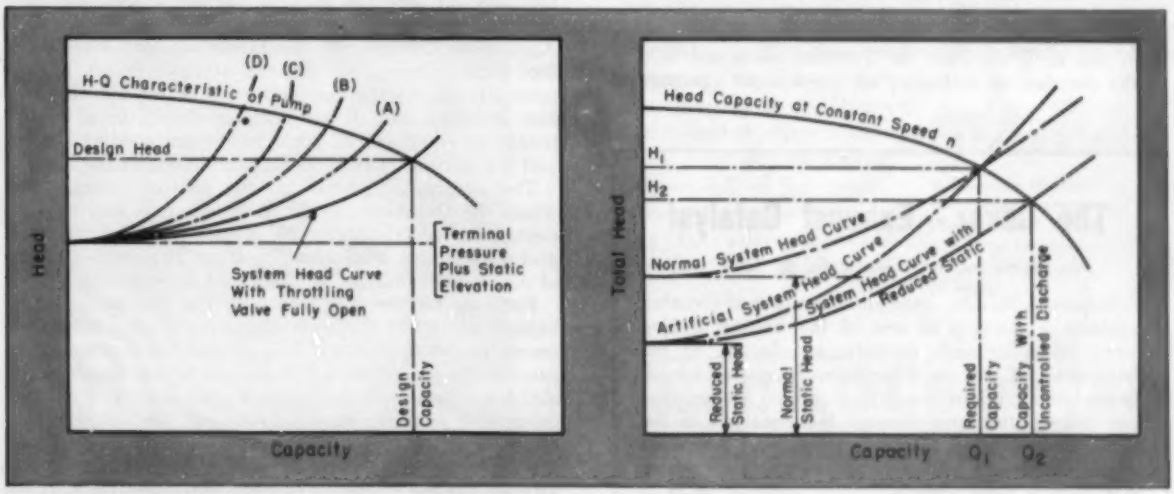
By-Pass Controls

By-pass controls perform an important function in any installation of centrifugal pumps where the system cycle is such as to introduce the possibility of operation at extremely reduced flows or against a completely closed discharge. However, it must be considered that when light-flow operations occur at extremely frequent intervals, as in a steel mill descaling installation, it may be more practical to maintain the by-pass valve constantly in the open position or to provide a three-way valve so that when the main flow is shut off, the by-pass flow is automatically established.

Water Hammer

To protect a system against the excessive pressures of water hammer, where it may occur, requires different solutions depending upon the probable surge pressure and the time from stoppage until the surge pressure has built up.

Flywheels, power operated check valves, air chambers, surge tanks, and similar devices are used to cushion systems against the pressures of water hammer.



Position of the throttling valve controls the pump operating conditions by varying the system head curve.

Required flow under reduced static head can be maintained by re-positioning the throttle valve control.

spot news

. . . what's happening in U. S. industrial plants

Neoprene Conveyor Belt Handles Oil-Treated Coal

With the decision to use coal in the new 75,000 kw No. 2 section at its Gadsby steam-electric plant in Salt Lake City, Utah Power & Light Co. faced the problem of dust control because of the plant's close proximity to city residential and commercial areas. Bituminous coal used would have to be treated with oil or some similar dust preventative agent.

The plant's complex conveyor system would be called upon to transport up to 400 tons of the oil-treated coal per hour. Natural rubber for the conveyor belt would quickly be deteriorated by hydrocarbons found in the oil-treated coal. Yet the flexibility and abrasion resistance of natural rubber were necessary.

According to T. A. Purton, Utah Power's chief engineer, the E. I. du Pont de Nemours neoprene belting finally decided on embodies all the desired qualities of natural rubber, yet is resistant both to oxidation and to deterioration by hydrocarbons. It has more strength and offers added protection against aging.

The coal conveyor system consists of six belt conveyors totaling 1121 ft in length. Belts are constructed of 5-ply, heavy duck neoprene covers. In use for more than a year, the belts have shown no signs of deterioration.

Neoprene has proven itself so well that Utah Power plans to build another 24 in. neoprene conveyor belt to serve the 100,000 kw No. 3 section now under construction at the Gadsby plant.

The Cover -- Exhaust Catalyst

Photo by Oxy-Catalyst Mfg. Co.

Eugene J. Houdry, catalytic scientist and inventor, explains a drawing of one of the enamel baking lines, complete with catalytic installation, at the Enamelstrip Corp. in Allentown, Pa. The solvent fumes driven off in the drying process go up and out the exhaust and through the catalysts in the stack. Heat created by the combustion of the fumes in the catalysts is piped back into the oven where it is used to bake enamel.

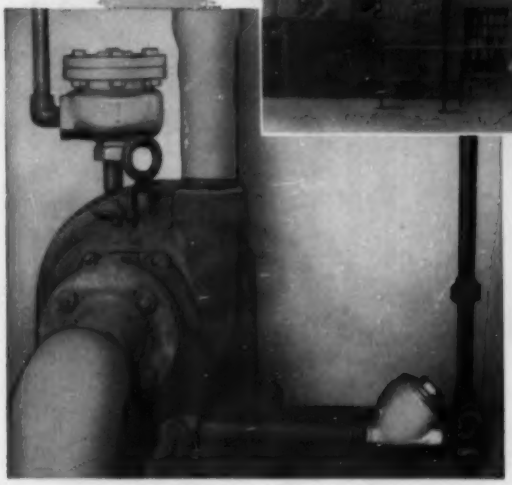
Detection System Guards Against Vapor Buildup

At the Standard Oil Development Company's research facilities at Linden, New Jersey, an automatic combustible vapor detection system developed by Mine Safety Appliances Co. guards constantly against leakage of fuel vapors throughout the two-story building. It continuously checks the atmosphere to determine—by precise measurement of air samples drawn to a central point—whether any of these petroleum products under test are getting "loose" in flammable concentrations.

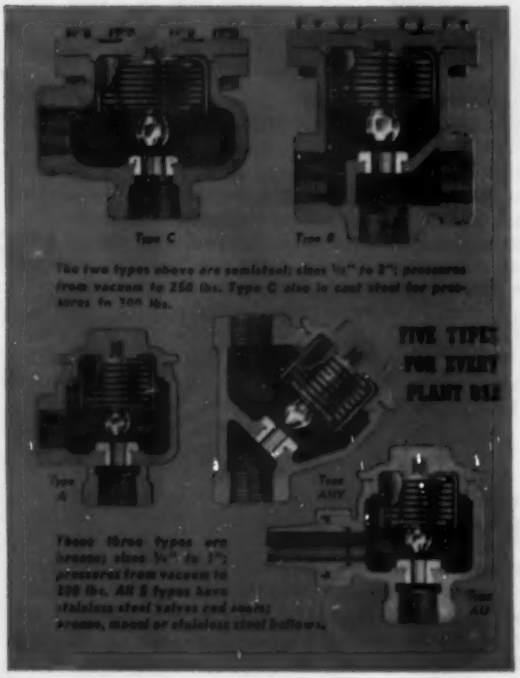
The centrally located master control panel, upon which the Combustible Gas Alarm unit is located, also contains a special graphic panel showing the entire laboratory layout in diagrammatic form. The precise source of the air sample being analyzed can be seen at a glance.

Each air sample is passed over the first of a pair of heated, sensitized platinum filaments which form a balanced electrical curcuit. The second filament, a compensator, is sealed in a cell containing uncontaminated air. Any combustible vapor in the air sample is burned on contact with the detector filament, the resulting increase in temperature producing a directly proportional increase in the ohmic resistance of the platinum wire. This upsets the electrical balance of the bridge in direct proportion to the vapor concentration. The indicating-contacting meter or relay measuring this unbalance is

NICHOLSON TRAPS SELECTED FOR *Celanese* STEAM PLANT



Above, enlarged steam generating facilities of the Celanese Corporation of America plant at Hopewell, Va., now in an extensive expansion program. Specified were Nicholson Steam Traps, two of which are shown at left.



How to use modern equipment to bring the steam generating capacity of a boilerhouse up to the needs of an extensive plant expansion program was recently demonstrated by Celanese Corporation of America at its Hopewell, Va., textile plant.

Stoker equipment to fit present space, and auxiliary equipment of the most modern nature -- all were selected with a view to attaining maximum efficiency, and desired capacity with a margin of space for further expansion. Nicholson Steam Traps were installed in connection with a new piping system which features return of the condensate and reclamation of most of its heat.

A recent survey showed these Nicholson features to be reasons why an increasing number of leading plants are standardizing on Nicholson thermostatic traps: 2 to 6 times average drainage capacity; shorten heat-up time. Operate at lower temperature differential; fast action keeps equipment full of live steam. Maximum air-venting capacity. Types for every process, power and heat application.

Send for
CATALOG 953

A 32-page standard reference; contains installation diagrams and data for determining proper size of trap.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

135 OREGON ST., WILKES-BARRE, PA.

Sales and Engineering Offices in 53 Principal Cities

Circle 542 on Reply Card for more data

HILCO LUBE and FUEL OIL PURIFICATION

Get Rid of Dirty Oil . . .
Get Lower Operating Costs,
Longer Equipment Life

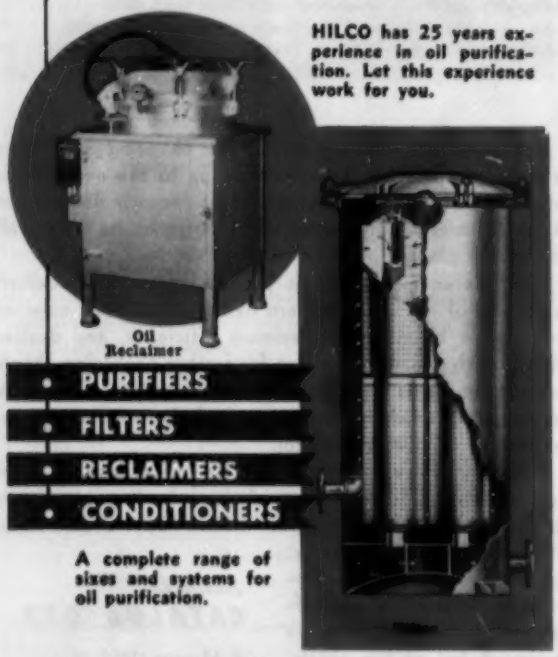
HILCO oil purification means complete oil purification! With a HILCO you get removal of sludge, acids, carbon, water and fuel dilution economically and efficiently. HILCO operation is continuous, all-electric and automatic.

Clean oil at all time reduces down time, increases production and HILCO units pay for themselves in savings.

HILCO offers a wide range of oil purification units . . . one to meet your needs. Write us about your equipment . . . and get recommendations at no obligation.

• THERE'S A **HILCO** FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM

HILCO has 25 years experience in oil purification. Let this experience work for you.



Oil Reclaimer

- PURIFIERS
- FILTERS
- RECLAIMERS
- CONDITIONERS

A complete range of sizes and systems for oil purification.

• WRITE FOR **FREE** LITERATURE ... NO OBLIGATION ON YOUR PART

THE HILLIARD Corporation
105 WEST FOURTH STREET
ELMIRA, N. Y.

In Canada: Upton-Bradeen-James, Ltd. • 990 Yonge St., Toronto 3464 Park Ave., Montreal

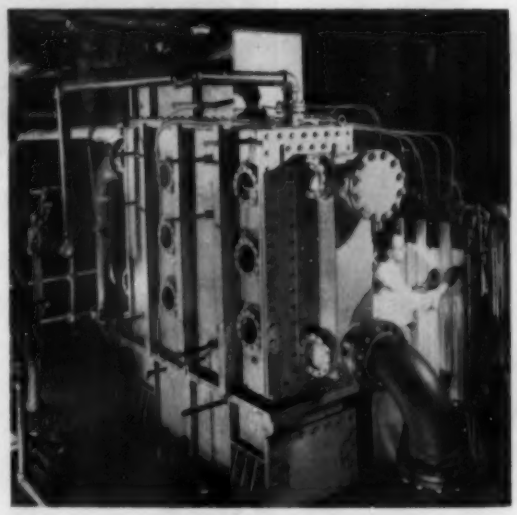
Circle 543 on Reply Card for more data

spot news

— Starts on page 86

so designed and calibrated that when the pointer is deflected to a pre-set point—in this installation 20 percent of the lower explosive limit—a magnetic circuit is closed. This energizes the alarm signal circuit of panel lights and klaxon "howler."

In many months of operation the alarm system has not been actuated except when deliberately "provoked" by dropping a gasoline-soaked rag near an air-sample intake point. This is done occasionally just as a maintenance check on the detection system.



Test Condenser Used to Study Design Problems

An experimental surface type steam condenser has been built by Allis-Chalmers Manufacturing Co. to accumulate heat transfer data which are expected to lead to improved commercial design.

The model has been designed to permit it to be adapted to various tube and baffle arrangements as well as different tube sizes and materials. Through the use of a removable type tube bundle, tests can be run which will allow the investigation of the heat transfer characteristics of a series of varied tube configurations.

Initial tests will use 280 ⅝-in. dia tubes to give a total effective surface area of 276 sq ft. The surface available in this condenser will then vary as different size tubes and tube configurations are used.

Special Plug and Fitting Used With Hot Tapping Method

Hot tapping is particularly important in pipeline work, since reasonably high average flow rates must be maintained to adequately supply communities with gas and other petroleum products.

An improved tapping procedure developed by T. D.

Only Chapman's *Tilting-Disc* Check Valves Give You...

NO SLAMMING
LOW HEAD LOSS
LOW WEAR

Here's the check valve that stays open with minimum flow resistance, closes fast without slamming, closes tight without sliding or scraping wear.

Cushioned Closing

Pressure against the upper part of the disc cushions it as it closes. Then the disc *drops tight* to its beveled seat after the valve has swung closed. Both actions are fast, but they are fluid-cushioned. Seating is quiet in all but unusual piping arrangements.

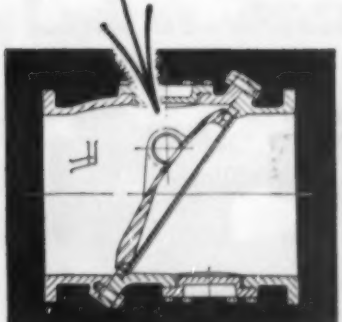
Low Flow Resistance

The streamline design of the valve body and disc eliminate turbulence and cut flow resistance. The fluid holds the disc tightly against its stops, without flutter. The body is larger around the disc, so the net valve area is at least as much as the pipe area.

Minimum Wearing Action

Because the disc *drops* tight, it doesn't slide against the seat. The wear on hinge pins is small because the disc doesn't flutter. Unusually husky construction in every detail means long life under the toughest conditions for Chapman's Tilting Disc Check Valve.

Full engineering and construction data are in Chapman's Catalog #30. Write for it now.

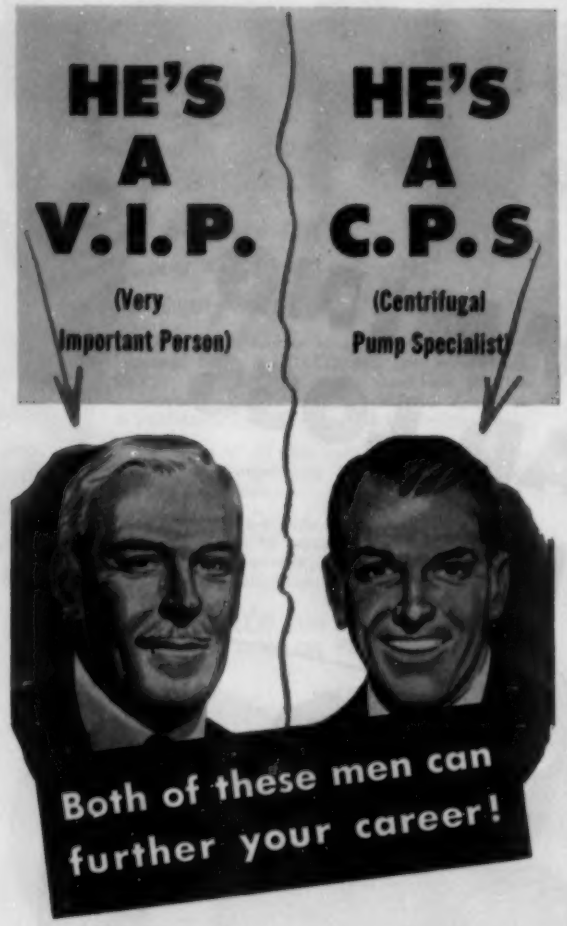


Here's Why CHAPMAN Tilting Disc Check Valves *Keep Quiet* All Their Lives

This specially designed "airfoil" disc balances perfectly in open position . . . then drops easily to closed position (cushioned by the flow). No jarring or slamming, in usual pipe-layouts. Write for bulletin.

The CHAPMAN VALVE Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

Circle 544 on Reply Card for more data



The C.P.S....Centrifugal Pump Specialist, from WEINMAN, is a V.I.P. in your life if you are responsible for the operation of pumps in your plant.

This fellow knows how to cut your pump costs. In fact, he's a specialist who can take the pressure off of you when it's caused by liquid handling problems. He will help you work out any pumping problem, whether it's application, installation or replacement, and free you for other plant problems.

You can depend on the advice and service of a WEINMAN Centrifugal Pump Specialist. He's devoted his entire career to WEINMAN Pumps He knows pump design and can recommend the right type for your special needs.

To get to know this V.I.P. in your life, write, wire or phone.

Representatives in principal cities

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

286 SPRUCE STREET • COLUMBUS 8 OHIO

Circle 545 on Reply Card for more data

spot news

—*Starts on page 86*

Williamson, Inc., Tulsa, entails the use of a special plug that makes it unnecessary to leave a gate valve attached to the branch connection; and a special fitting, fabricated with a Tube-Turn barrel-shaped tee, which gives the 360 degree reinforcement desirable when dealing with high pressures and large diameter pipe and taps. The tee is split longitudinally on a horizontal plane, perpendicular to the axis of the outlet. The ends of the run incorporate a welded in ring attachment that permits a close fit to the OD of the pipe. After the fitting is clamped to the pipe, its halves are butt-welded and girth welds are made at the extreme ends of the run. The annular space between the fitting and pipe minimizes any welding hazards adjacent to the pipe and permits good root penetration. The Williamson hot tap fittings are available in sizes 2 through 24 in., for pressures up to 1800 psi.

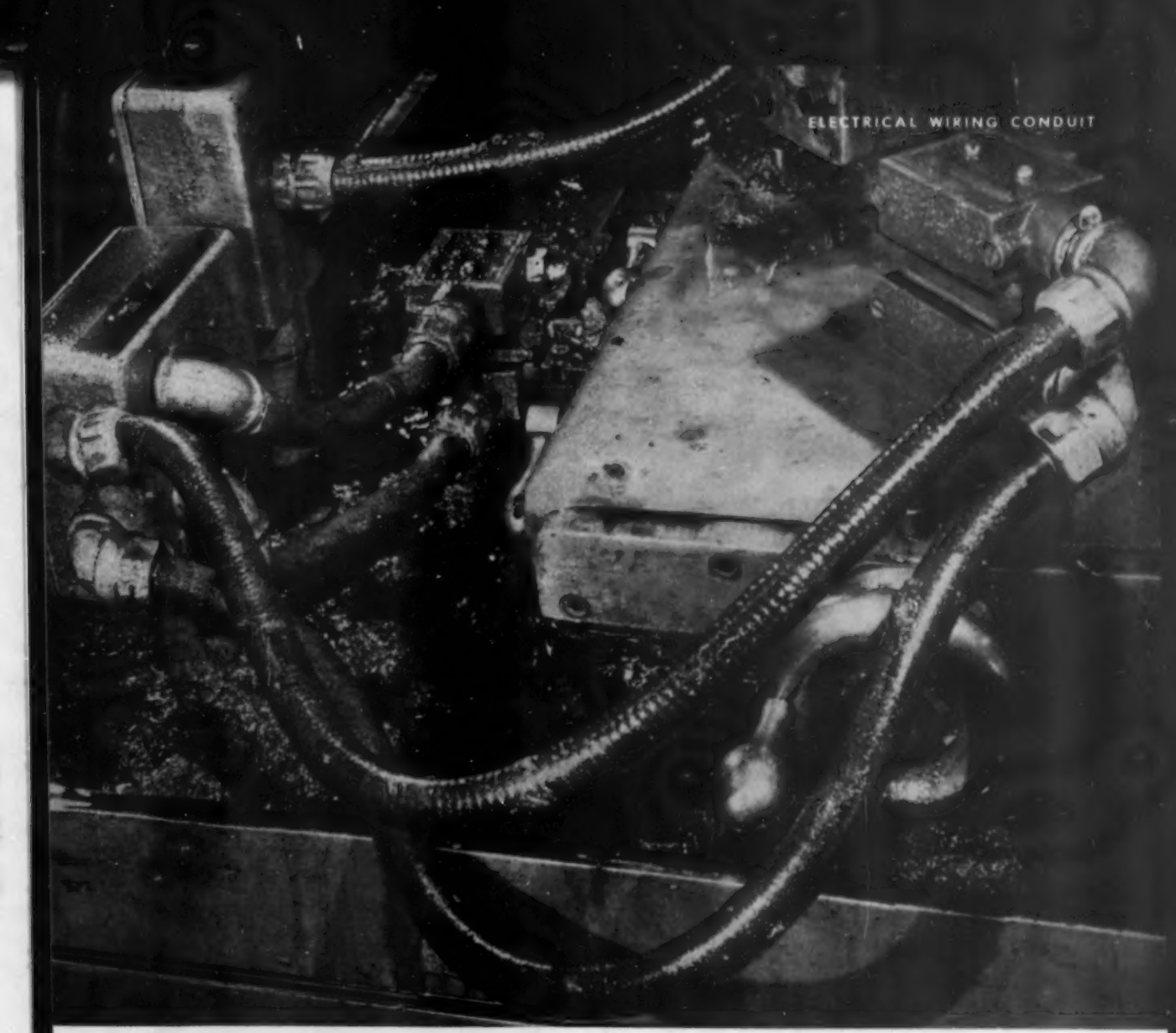
Tube-Turn products are manufactured by Tube Turns, Louisville, Kentucky.

Shipping Simplified With Use of Metal Lath Package

Costly storage, shipping, and handling problems in the use of metal lath are said to be surmounted by a new engineered package developed by Wheeling Corrugating Co.

Diamond mesh lath is now available in 50 bundle (500 sheets), compact units, securely packed and banded at the factory; designed for swift handling with fork truck or crane. In the past, ten-sheet bundles arrived at dealer warehouses and had to be handled individually, a process which required approximately a full day's labor of four workers. Lath in this form would not stack higher than 100 bundles to a pile because of bowing. At best the stacks were shaky, resulting in a safety hazard.

When Wheeling's new package arrives at the warehouse, one man with a fork truck can unload a car in 45 min. In the warehouse, the dealer can stack packages as high as ceilings permit without fear of instability or



PRODUCTION GRINDER IS TOUGH TEST for wiring conduit. SEALTITE passes easily...protects against grinder dust, oil, coolant, and movement.

Tough synthetic cover on this conduit keeps these control wires working

IT'S SEALTITE* ELECTRICAL WIRING CONDUIT . . . PROTECTION AGAINST ENEMIES OF WIRING

SEALTITE was made to handle trouble. Oil and grease. Weather, water and dirt. Chemicals, corrosive fumes and salt spray. None gets by SEALTITE's synthetic jacket. Wiring can't be damaged. Protection is complete.

But SEALTITE offers more than just toughness. It is light and flexible. It installs easily in cramped spaces. It absorbs vibration—takes movement. And it hugs motor contours . . . looks neat.

Liquid-tight SEALTITE is the first conduit of its type to be approved by Underwriters' Laboratories, Inc. for use where exposed to moisture and mineral oils. (See N.E. Code, Art. 351.) For tight bends on machine tools and industrial equipment, use SEALTITE Type EF (Extra Flexible). It meets standards set by J.I.C.

Electrical wholesalers stock both types in coils. Buy it this way; then cut without waste. Wholesalers also stock standard liquid-tight fittings for use with SEALTITE.

*Trademark 54178

SEALTITE

flexible, liquid-tight electrical conduit

an ANACONDA® product

The American Brass Co., American Metal Hose Branch, Waterbury 20, Conn.
Please send me descriptive booklets on SEALTITE Electrical Wiring Conduit.

NAME.....
PLEASE PRINT

COMPANY.....

STREET.....

CITY..... ZONE..... STATE.....

Circle 546 on Reply Card for more data

IT'S EASY TO MAKE

Repairs

LIKE THESE...

Just mix and fix—it's easy with Smooth-On No. 1 Iron Cement. You can seal cracks in pipes, boilers, metal containers . . . tighten loose screws and fixtures in wood, metal or tile . . . anchor bolts in concrete. Smooth-On expands as it sets and hardens like iron. Makes a tight, lasting repair that virtually becomes a part of what it fixes. Keep a can on hand (Smooth-On doesn't deteriorate) and use it as you need it—at a cost of only a few pennies per repair.

FREE
REPAIR HANDBOOK

New, completely revised, 48-page illustrated handbook has hundreds of time and money saving repair tips for jobs in the plant and around the home. Millions of these repair handbooks have been distributed during our 58-year history. Write for your copy today.

90 491

SMOOTH-ON MANUFACTURING CO. Dept. 19
570 COMMUNIPAW AVE., JERSEY CITY 4, N. J., U. S. A.

SMOOTH-ON
THE IRON CEMENT OF MANY USES

Circle 547 on Reply Card for more data

spot news

— Starts on page 86

warping. They are usually stacked four high, increasing storage space by 50 to 100 percent.

Furnace Lining Failures Can Be Prevented

Before melting brass, aluminum, or stainless steel, two simple precautions can eliminate nine out of ten troubles originating later in induction furnace refractory linings.

Causes for most furnace lining failures are improperly rammed cement and insufficiently vitrified facing according to findings of Electro Refractories & Abrasives Corp.

To overcome this, each successive portion of cement should be put in to interlock with the previous portion. Then the new lining should get sufficient firing for the necessary vitrification before the furnace is placed in actual operation.

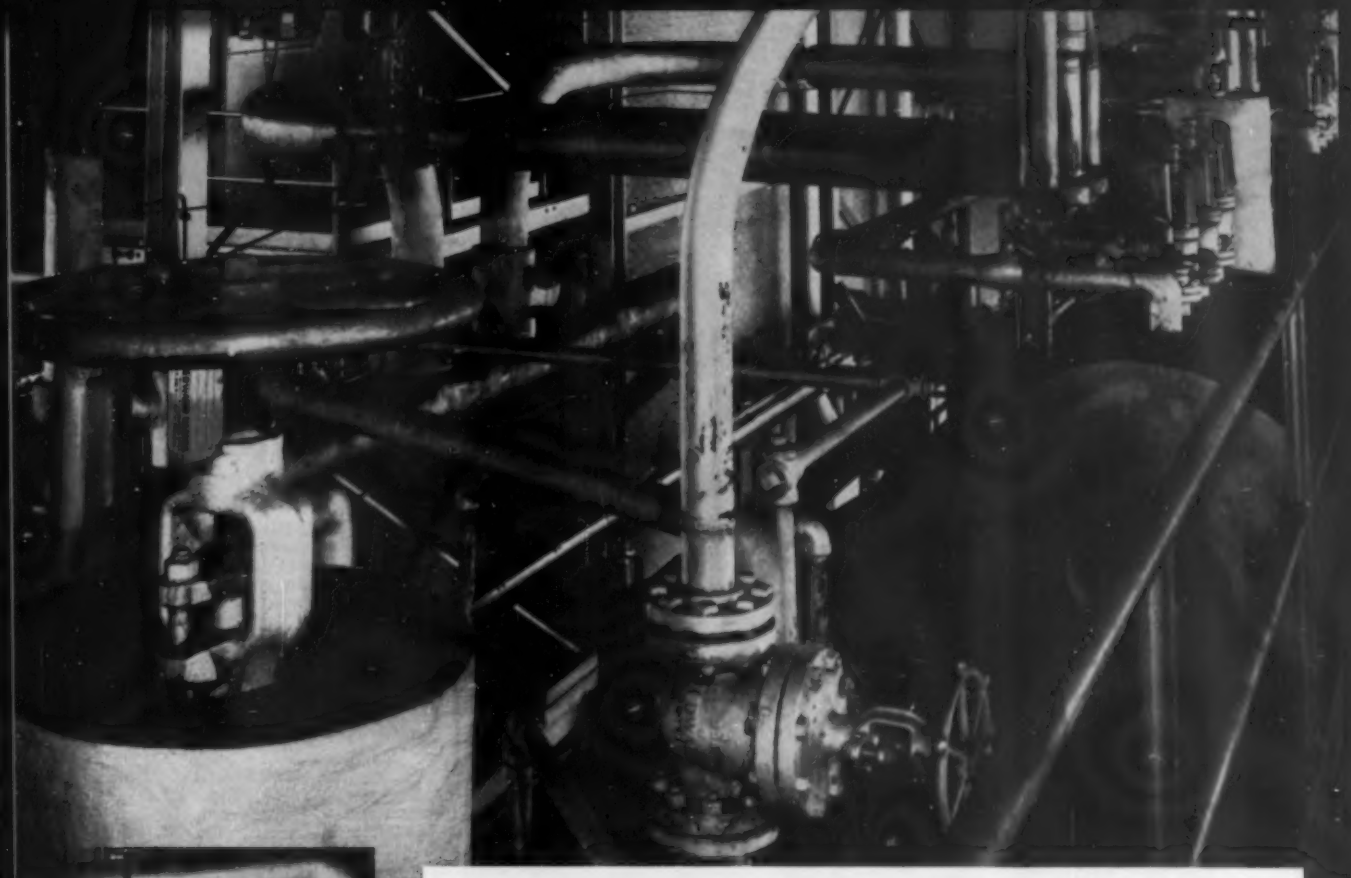
Pre-use firing temperatures will vary somewhat depending upon the cement used. New cements are now being developed by ER&A to withstand even higher temperatures.

Burning Hogged Wood Refuse Cuts Fuel Costs

Increased steam requirements and cost of supplementary fuel prompted a large veneer and lumber mill to install a wood burning Flo-Matic Fyr-Feeder stoker manufactured by the American Coal Burner and Wood Stoker Corp.

One of their 150 hp horizontal return tube boilers was reset and the furnace arranged to burn hogged wood refuse. The spray-spread system employed by the Flo-Matic Fyr-Feeder for introducing hogged fuel into the

(Continued on page 113)



How Edward Steel Valves Cut Maintenance in a Hospital 150 lb sp Boiler Plant

RAY D. GANGWER, Chief Engineer, Gets Dependability, Saves on Replacements and Repairs with Steel Valves

Buying EDWARD 300 lb sp steel valves for 150 lb sp service proved a good investment at The Dr. Norman M. Beatty Memorial Hospital, Westville, Indiana.

Years ago, labor for repairing or replacing valves was relatively inexpensive. But, today, labor often costs more than the valve. So, for economy, the feedline, non-return, main steam distribution, blow-off and miscellaneous drain, gage and auxiliary valves in this steam generating plant are steel.

Maintenance personnel at the hospital like trouble-free Edward steel valves. Edward's dependability and low maintenance requirements more than justified their slight additional cost over the usual low pressure valves.

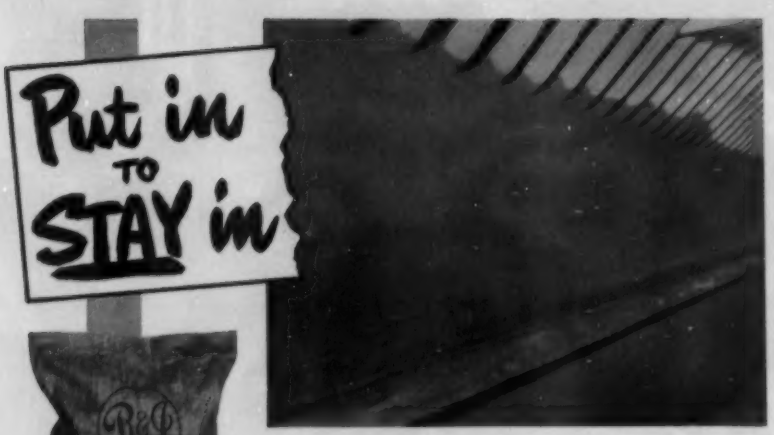
You, too, can cut your maintenance expense with low-cost Edward steel valves. Call the nearest Edward representative or contact Edward Valves, Inc., today.

The first of a series of case histories on the use of Edward steel valves in "under 300 lb sp" service.

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY
40 WEST 144TH STREET
EAST CHICAGO, INDIANA

Circle 548 on Reply Card for more data



As much as
10 years' service
without replacement

That's only one of many records for

MOLDIT CASTABLES
in ash hoppers

✔ A large power plant had to repair a number of ash hoppers, remove spalled and shaled fire brick and replace with new material. Estimated cost—$30,000, plus considerable boiler outage. But R & I recommended thorough raking out, cleaning and wetting down of all broken, spalled and eroded areas, and the holes and openings filled and plastered with Moldit-D Refractory Cement to a smooth, level surface. This was done more than 10 years ago. Today the Moldit-D refractory is still in place, withstanding hard usage and frequent, large quantity cold water quenchings of the hot ash. All this at about one-fourth the estimated cost!

✔ Heavy repairs to ash hoppers with prolonged shut-downs used to cost another large power plant many thousands of dollars until they tried Moldit-D. As a result, maintaining these hoppers of eight 500,000-lb. stoker-fired boilers as well as a number of smaller boilers has been cut about 90% a year.

✔ The Moldit-D linings installed eleven years ago in ash hoppers of two 800,000-lb. pulverized fuel boilers are still going strong. Not a single repair has been necessary! The original application was made on the walls and ends of the hoppers, at a cost of a few cents per pound, plus very little labor. Figure this out in terms of labor and material for equivalent fire brick lining including the cost of maintaining and repairing it for eleven years. It would be staggering!

The Moldit success story is endless—wherever refractory linings are used. There's a Moldit Cement for every castable refractory need.

Pour It—Gun It—Trowel It—MOLDIT

REFRACTORY & INSULATION CORP.

REFRACTORY BONDING AND CASTABLE CEMENTS
INSULATING BLOCK, BLANKETS AND CEMENTS

130 WALL STREET • NEW YORK 5, N. Y.
Circle 549 on Reply Card for more data

names make news

The Marley Company's new plant in Louisville, Ky. adds 77,000 sq ft of production space for the fabrication of packaged water cooling towers.

Worthington Corp.—Harold P. Mueller, president of the L. J. Mueller Furnace Co., and **Hobart C. Ramsey,** president of the Worthington Corp., announce an agreement for the transfer of the net assets, name, and goodwill of Mueller to Worthington in exchange for Worthington common stock. The Mueller plant and facilities would be operated as the Mueller Climatrol Div. of Worthington.

Okonite Co. announces that The Okonite-Callender Cable Co., Inc., its wholly-owned subsidiary, will be merged with the parent company.

Standard Pressed Steel Co.—Francis J. Kinsella has been named manager of outside sales. He succeeds **George A. Gade** who was elected vice president in charge of sales last year.

American Locomotive Co. announces the retirement of **Duncan W. Fraser** as chairman of the board of directors. He has been with the company since 1901.

Minneapolis-Honeywell Regulator Co., Brown Instrument Div.— **C. L. Peterson** is appointed divisional vice president and **O. B. Wilson** takes over as general sales manager.

Elliott Co. announces opening of a new sales office in New Orleans at 256 Lee Circle Bldg., to service southern Mississippi and Louisiana. Its staff includes **G. C. Bayles** as manager, and **C. W. Britt, Jr.,** both formerly in the company's Atlanta office.

F. L. Humphrey, Jr. is named assistant district manager for their Atlanta territory.

The Buck Electrical Manufacturing Co.—Officers of the newly formed company include **Stephan N. Buchanan** president, **Daniel B. Kusiv** vice-president and general manager, and **John K. Leeds** secretary-treasurer.

Link-Belt Co. appoints **John D. Riley** as district manager of its Cleveland, Ohio office and **Harry G. Andersen** as district manager of the Newark, N. J., office.

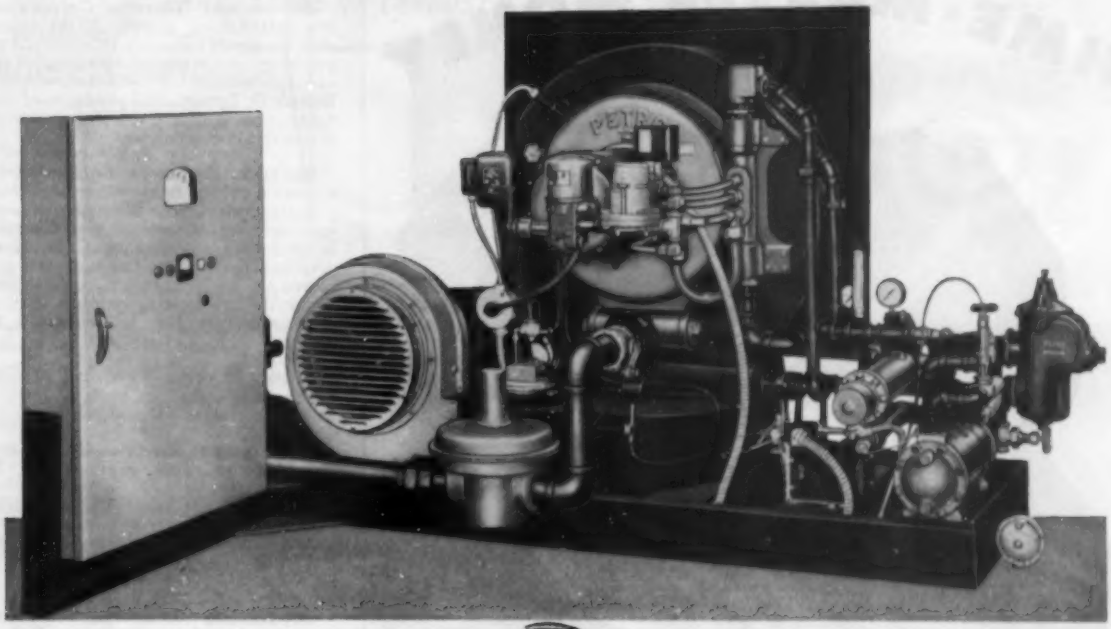
Robertshaw-Fulton Controls Co.—Ground has been broken for a new 237,000 sq ft plant in Long Beach, Cal., to house the Grayson Controls Div.

Robert O'Hara is added to the staff of the Detroit office of the Fielden Instrument Div.

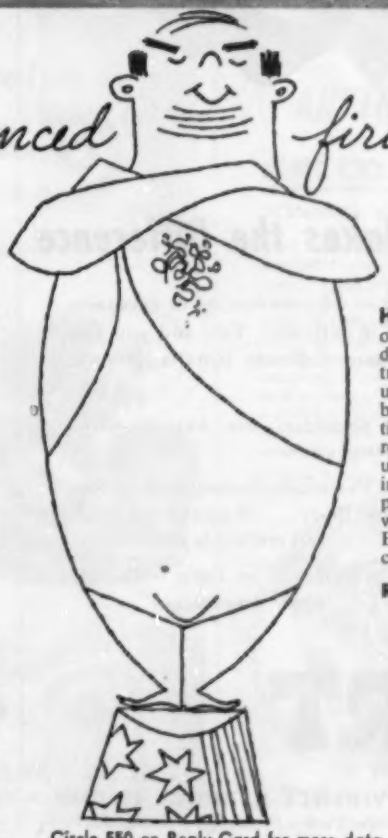
Stevens Institute of Technology—Richard H. DeMott, chairman of the board and president of SKF Industries, Inc., has been chosen to receive the Stevens Honor Award, bestowed each

Petro

COMPLETE PACKAGED UNIT OIL, GAS, OR OIL-GAS COMBINATION BURNERS



a perfectly-balanced firing system...



FOR OIL...

Burns any weight oil with complete dependability. Consists of heavy duty Petro horizontal rotary oil burner with steel windbox, refractory tile burner throat, secondary air volume control, motor-driven forced draft fan, and electrical control panel, all mounted on a rugged structural steel base, factory-wired and tested.

FOR GAS...

High combustion efficiency is obtained from all types of fuel gas with this ring-type forced draft burner. Fully modulating automatic controls supply fuel and air in exact proportions required to meet load demands, with excellent fuel economy. Combustion constantly monitored by electronic controls.

FOR BOTH...

Two complete burners—one for oil, one for gas—function independently. Fuels can be switched in a matter of seconds without loss of steam pressure, water temperature, or interruption of production. Gives alternate stand-by fuel and permits taking advantage of fuel price fluctuations. Write Petro, 3025 W. 106th Street, Cleveland 11, Ohio. In Canada: 2231 Bloor St. West, Toronto, Ontario.

in ONE factory-assembled and tested unit

HERE THEY ARE—all the essential components of a modern firing system . . . burner, forced draft fan, air volume control, and enclosed electrical control panel in *one* complete packaged unit. It provides a sure way to modernize any boiler room for dependable, economical operation. Engineered to fit specific boiler and fuel requirements, it is installed as an integral working unit. Fully modulating controls follow variations in load demands. Forced draft system gives peak performance from the moment the burner starts, without dependance on high stack for draft. Exceptionally quiet operation. Write for specification sheets and full details.

Residential Oil and Gas Burners, Oil and Gas Furnaces and Boilers, Industrial and Commercial Oil, Gas and Oil-Gas combination Burners

PETRO

T. M. REG. U. S. PAT. OFF.

OVER 50 YEARS OF LEADERSHIP IN AUTOMATIC HEATING AND POWER EQUIPMENT

Circle 550 on Reply Card for more data

SAVES

TIME · MUSCLE · MONEY

This True Ball Joint Makes the Difference

Darts give a snug, drop-tight fit easily — without fussing or excessive wrenching — there's no lost time in installation. Yes, and you can use Darts over and over again on many different installations for real economy!

QUICK FACTS

- *Leakproof* because precision-machined to a true ball joint and spherically ground
- Bronze alloy seats are extra wide, resist pitting and corrosion
- Shoulders are heavy — withstand abuse
- Practically indestructible Nut and Body . . . of air-refined, high test malleable iron

Insist on Darts — they're a real *investment*

DART

UNIONS

DART UNION COMPANY • PROVIDENCE 5, RHODE ISLAND

The Fairbanks Co. — Distributors: Boston • New York • Pittsburgh • Rome, Ga.

Circle 551 on Reply Card for more data

names

— Starts on page 94

year by Stevens Institute on outstanding figures in American life.

Aerotec and Thermix Corporations are establishing a new $5000 fellowship for graduate study in electrical engineering at Carnegie Institute of Technology. Winner of the fellowship is **Robert D. Lynch,** 1953 graduate of Carnegie, who is now a doctoral candidate in electrical engineering.

Electrical Engineers Equipment Co. announces three promotions within the organization. **Chris Christensen,** chief engineer is promoted to vice president in charge of engineering. **C. A. Koerner,** assistant chief engineer, is promoted to chief engineer, and **Arthur Reynolds** has been promoted to sales promotion manager, following the retirement of **R. T. Calloway.**

Federal Electric Products Co.—W. Raymond Parshall is named treasurer and a director of the company.

Chandeysson Electric Co. names **Ralph Morse,** plant engineer. In his new capacity, he will supervise plant utilities, construction, and maintenance.

New York & New Jersey Lubricant Co. announces the addition to New England sales staff of **E. J. Wood.**

The Heating and Cooling Coil Manufacturers Association has elected as officers for 1954: **P. G. Kayser,** McQuay, Inc., president; **W. C. Jones,** Westinghouse Electric, vice-president; **G. W. McCormick, Jr.,** secretary-treasurer.

American Flexible Coupling Co.—Hunley A. Slaughter formerly with Craig Sales & Engineering Co., is appointed district manager in Tennessee and Arkansas.

General Electric Co.—Edward E. Bauer is appointed superintendent of regulator manufacturing for the Power Transformer Dept.

Industrial Unit Heating Association officers for 1954 are **I. W. Clark,** American Air Filter Co., president; **W. G. Schlichting,** Young Radiator Co., vice president; and **G. W. McCormick, Jr.,** secretary-treasurer.

Internal Combustion Engine Institute—J. E. Heuser, Le Roi Co. is elected president; **B. G. VanZee,** Minneapolis-Moline Co. vice president; **H. W. Smith,** Caterpillar Tractor Co., secretary; and **J. D. Cook,** Hercules Motor Corp., treasurer.

Anaconda Wire & Cable Co.—Albert H. Leader is appointed district manager for the Seattle office. He succeeds **Lloyd Wolfe,** who retires after 32 years.

American Gear Manufacturer's Association headquarters are now at One Thomas Circle, Washington 5, D. C. The new office will be manned by **Gerald L. Scott,** staff engineer, **Robert F. Klose,** office manager, and **J. C. Sears,** executive secretary.

LISTEN

STOP THE
WHAM-WHAM-WHAM
OF THAT INTAKE OR EXHAUST

with a
BURGESS-MANNING SNUBBER

There is no engine, compressor, blower, vacuum pump, steam or gas turbine too large or too small to be effectively silenced by a Burgess-Manning Snubber.

Too—they give you a choice of plus values as: combination of noise reduction and air cleaning —or heat recovery—or spark arresting — or surge control — or water separating. Insure greater equipment efficiency, better oral communication in your plant, and prevent costly compensation claims.

We invite you to submit your problems — no obligation.

BURGESS-MANNING COMPANY

733 East Park Avenue, Libertyville, Illinois

Circle 552 on Reply Card for more data

How you can get longer pump-valve life

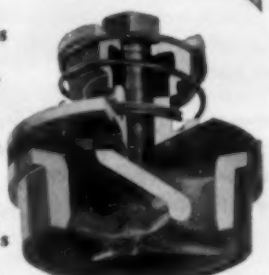
SIMS PUMP VALVES HAVE FOUR FEATURES THAT GUARANTEE LONGER LIFE

1 Double shock absorber stem heads—eliminate stem breakage.

2 Long guide—low wear—even lift, no binding. Spring can't jam.

3 Rotating valve disc—wears slowly, evenly; can't pound up and down on same spot.

4 Inclined seat ribs—less flow-resistance, reduce volatilization, allow higher pump speeds with a full cylinder—more output.



Complete stocks on hand. • Used by blue chip companies throughout the U.S. • Ask for Bulletin IP-4 or a report on what these valves can do for you—no obligation.

Sims

PUMP VALVE CO., INC.

1314 PARK AVENUE, HOBOKEN, N. J.

SP-109 M&M BLDG., HOUSTON, TEXAS

Circle 553 on Reply Card for more data

FAST! EASY! **convenient...**

MANAGEMENT: For Copying Letters, Reports, Contracts, Instructions, Statistics, Etc.

SALES: For Copying Orders, Letters, Inquiries, Presentations, Price Sheets, Etc.

PHOTOCOPYING

MANUFACTURING: For Copying Schedules, Work Sheets, Control Sheets, Master Records, Inventory Records, Etc.

SHIPPING: For Copying Receipts, Claims, Freight Bills, Packing Slips, Bills of Lading, Etc.

Use It To Copy *ANYTHING right in your own office!*

APECO *Systematic Auto-Stat*

EVERY DEPARTMENT can use the Apeco Systematic Auto-Stat. This new all electric photocopying machine prints, processes and dries automatically. It's fast—dry copies in less than 45 seconds! It's convenient—fits on the corner of any desk . . . it's ready for instant use! It's easy—anyone can operate it! Saves up to 80% on copying jobs. Eliminates retyping, hand copying, checking or costly outside copying service. Makes legally accepted black and white or colored copies from any original up to 11" x 17" —printed on one or two sides. So low cost—a complete Apeco Systematic Auto-Stat installation is priced well within the budget of even the smallest firm.

Lifetime Service Guaranteed

American Photocopy Equipment Co.
1979 W. Peterson, Chicago 26, Illinois

RUSH ME NEW PHOTOCOPY INFORMATION KIT containing booklet on the Apeco Auto-Stat plus separate folders on copying tax returns, color copying and copying on preprinted forms.

Name_____

Firm_____

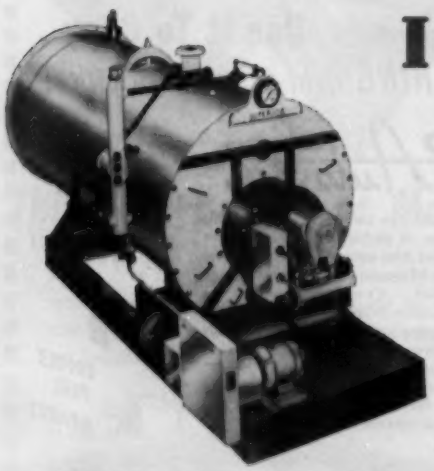
Address_____

City_____ State_____

In Canada: APECO OF CANADA, LTD., 134 PARK LAWN ROAD, TORONTO, ONT.

Circle 554 on Reply Card for more data

only a TRUE PACKAGED boiler IS TESTED like this.



18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for Catalog 602.

At the Superior factory in Emmaus, Pa., every steam generator is thoroughly tested before shipment. This is one of the outstanding advantages of the *true* packaged steam generator. Completely assembled at the factory with burner and all boiler trim installed, it is set on a testing line, connected to service supplies, and fired. During this test firing period, trained technicians thoroughly check on all points of performance and make whatever adjustments are necessary to bring the unit into top operating condition.

Then, and then only, is a Superior Steam Generator shipped . . . with a written guarantee based on the results of this actual test firing. There's no guesswork about Superior Steam Generators. Every guarantee is based on the actual performance of the unit to which it applies.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N. Y.

SUPERIOR STEAM GENERATORS

Circle 555 on Reply Card for more data

readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pages 34/35 & 98/99

Key No.	Advertiser	Product	Page No.
	AIR FILTERS & DUST COLLECTORS		
537	Aerotec Corp., The	Electrical precipitators	49
569	Buell Engineering Co.	Dust Collection	108
541	Prat-Daniel Corp.	Dust Collectors	82
	BOILERS & BOILER ACCESSORIES		
534	Bell & Zoller Coal Co.	Coals	46
531	Bituminous Coal Institute	Coals	43
513	Chesapeake and Ohio R.R.	Coals	22
516	DeLaval Steam Turbine Co.	Boiler feed pumps	25
575	Diamond Power Specialty Corp.	Boiler water gage	111
525	Engineer Co., The	Gas-oil burning unit	36
557	General Coal Co.	Coals	100
528	Hoffman Specialty Mfg. Corp.	Boiler vacuum pumps	40
520	National Airoil Burner Co., Inc.	Oil burners	30
515	Peabody Engineering Corp.	PK-54 burner	24
550	Petro	Burner unit	95
541	Prat-Daniel Corp.	FD fans, ID fans, air heaters	82
518	Preferred Utilities Mfg. Corp.	Unit steam generators	28
555	Superior Combustion Industries Inc.	Steam generators	98
579	Wickes Boiler Co., The	Steam generators	115
527	Yarnall-Waring Co.	Boiler water gages	38-39
	BUILDING MATERIALS & MAINTENANCE		
578	Flexrock Co.	Concrete floor patch	114
547	Smooth-On Mfg. Co.	Iron cement	92
	ELECTRICAL EQUIPMENT		
546	American Metal Hose Br., The American Brass Co.	Flexible electrical conduit	91
526	Arrow-Hart & Hegeman Electric Co., The	Loom switch	37
565	Ideal Industries, Inc.	Motor maintenance	105
511	I-T-E Circuit Breaker Co.	Switchgear equipment	18-19
561	U. S. Electrical Motors, Inc.	Totally-enclosed motors	101
521	Wiegand Co., Edwin L.	Electric heating units	31
	ENGINES & TURBINES		
552	Burgess-Manning Co.	Snubber	97
517	General Electric Co.	Type DP turbines	26-27
540	Terry Steam Turbine Co.	Steam turbines	78
507	Worthington Corp., Steam Turbine Div.	Steam turbines	11
	FANS & BLOWERS		
523	Coppus Engineering Corp.	Ventilator-exhauster	33
500	Hartzell Propeller Fan Co.	Fans & blowers	2
	HEATING, AIR CONDITIONING & REFRIGERATION		
529	Vogt Machine Co., Henry	Refrigeration condensers	41

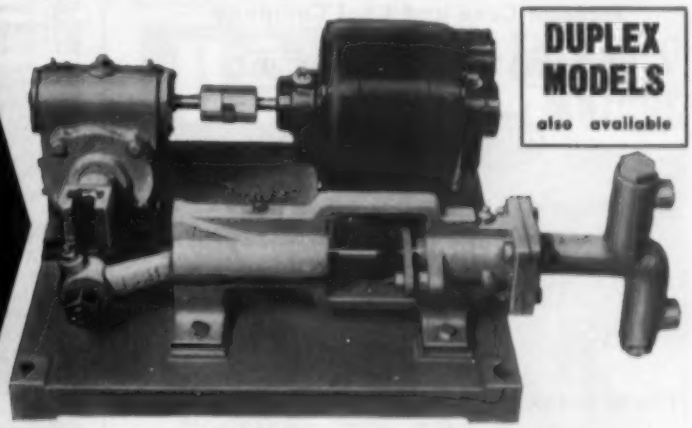
(Continued on next page)

for water softening, boiler treatment and all chemical applications.. we introduce

ORCHEM

LITTLE GIANT PUMP

small . . . compact . . . efficient . . . economical . . .



DUPLEX MODELS also available

As its name implies, the *Orchem Little Giant Pump* is small and compact. But it's designed to do a *big* job, economically. It's ideal for water softening, boiler treatment and all chemical applications up to a P.S.I. of 800 lbs.

In addition to the *Little Giant*, Orchem makes many types and sizes of standard and special pumps for every conceivable purpose. Efficient and economical, the *Little Giant Pump's* advantages result from Orchem's many years of "know-how".

Every Orchem pump is thoroughly tested for volumetric efficiency, conformance to pressure requirements and general mechanical operation under actual operating loads.

Write for descriptive literature. Furnished in Simplex and Duplex design for capacities to 3000 G.P.H. and pressures up to 30,000 P.S.I.

EXCLUSIVE "INJECTO" VALVE

Suction and discharge sides consist of a radically new integral double ball and seat unit—two balls and two seats—in one complete unit. Direct flow in and out assures minimum slippage. Non-air binding. Maximum displacement efficiency. Inexpensive units easily removed with large standard screwdriver.

MANAJUST . . Manual Stroke Adjustment

Standard on all Orchem pumps. Permits accurate control and repeatability from 0 to 100% of ratio capacity, adjustable when pump is not in operation. Locks in place for safety regardless of pressure.

Sales Representatives in Principal Cities

ORCHEM PUMP DIVISION, 4434 Salmon St., PHILADELPHIA, PENNSYLVANIA

Circle 556 on Reply Card for more data

Westmoreland Coal Company

CRITERION COAL · HAMPTON COAL

We are proud to be affiliated with the Westmoreland Coal Company, which is celebrating its 100th Anniversary in 1954.

Stonega Coke and Coal Company

GLENBROOK · RODA · CROSSBROOK · STONEGA · DENDRON

Page Coal and Coke Company
Crozer Coal and Land Company

LYNCO · CROZER

ANTHRACITE

Hazle Brook Raven Run Cross Creek

Hazle Brook Coal Company
Jeddo-Highland Coal Company

SPONSORING MEMBER · COAL HEATING SERVICE · NATIONAL COAL ASSOCIATION

General Coal Company

123 SOUTH BROAD STREET . . . . . PHILADELPHIA 9, PA.

Cable Address: GENCO

Branches

BLUEFIELD, W. VA. · BUFFALO · CHARLOTTE, N. C.
CINCINNATI · CLEVELAND · IRWIN, PA.
NEW YORK · NORFOLK

Circle 557 on Reply Card for more data

readers' guide

— Starts on page 99

Circle key numbers on Reply Cards for more data

Key No.	Advertiser	Product	Page No.
	INSTRUMENTS & CONTROLS		
567	Electric Auto-Lite Co.	Temperature recorders	107
524	Hays Corp., The	Draft gage	34
573	Liquidometer Corp., The	Tank gage	110
514	Powers Regulator Co., The	Water temperature controls	23
	LUBRICANTS & LUBRICATION EQUIPMENT		
543	Hilliard Corp., The	Oil purification units	88
570	Manzel Div. of Frontier Industries, Inc.	Automatic lubricator	109
564	New York & New Jersey Lubricant Co.	Non-Fluid oil	105
512	Shell Oil Co.	Diesel cylinder lubricants	21
533	Standard Oil Co. (Ind.)	Turbine oils	45
539	Sun Oil Co.	Hydraulic oils	77
	MATERIALS OF CONSTRUCTION		
522	International Nickel Co., Inc., The	Inconel "X"	32
	MATERIALS HANDLING EQUIPMENT		
568	Sweet's Catalog Service	Plant engineering file	107
	MECHANICAL POWER TRANSMISSION		
530	Gates Rubber Co., The	V-belts	42
501	Goodyear Tire & Rubber Co.	Flat transmission belt	3
508	Jeffrey Mfg. Co., The	Feeders & belt conveyors	13
503	Lewellen Mfg. Co.	Transmissions & motor pulleys	6
519	Link-Belt Co.	Car shakers & rotary dumpers	29
563	Lovejoy Flexible Coupling Co.	Variable speed pulleys	104
535	Raybestos-Manhattan, Inc. Manhattan Rubber Div.	Whipcord belts	47
558	Standard Pressed Steel Co.	Solid steel collars	101
	PIPE, TUBING & HOSE		
551	Dart Union Co.	Ball joint unions	96
510	Grinnell Co., Inc.	Pipe hangers & supports	17
580	Shaw Co., Benjamin F.	Piping fabrication	116
	PUMPS & COMPRESSORS		
577	Armstrong Machine Works	Air traps	114
559	Aurora Pump Co.	Centrifugal pumps	101
556	Orchem Pump Div.	Little Giant pump	99
553	Sims Pump Valve Co., Inc.	Pump valves	97
545	Weinman Pump Mfg. Co., The	Centrifugal pumps	90
506	Worthington Corp., Vertical Turbine Pump Div.	Vertical turbine pumps	10
	REFRACTORIES & INSULATION		
549	Refractory & Insulation Corp.	Refractory cement	94
532	Universal Atlas Cement Co.	Refractory concrete	44
	STEAM SPECIALTIES		
571	Jerguson Gage & Valve Co.	Steam gages	109
560	Sarco Co., Inc.	Camlift bucket trap	101
542	Nicholson & Co., W. H.	Steam traps	87
538	Yarnall-Waring Co.	Steam traps	50
	TOOLS		
576	Wilson, Inc., Thomas C.	Tube cleaner	113
	VALVES & REGULATORS		
544	Chapman Valve Mfg. Co., The	Check valves	89
548	Edward Valves, Inc.	Steel valves	93
562	Everlasting Valve Co.	Boiler blow-off units	103
504	Leslie Co.	Reducing valves	7
566	Rockwell Co., W. S.	Butterfly valve	106
574	Skinner Co., M. B.	Valve & bibb reseater	111
536	Spence Engineering Co., Inc.	Temperature regulator	48
	WATER TREATMENT & WASTE DISPOSAL		
505	Betz, W. H. & L. D.	Water conditioning	9
502	Cochrane Corp.	Water conditioning	4
509	Dearborn Chemical Co.	Water treatment	14-15
572	Hungerford & Terry, Inc.	Water treatment	110
	MISCELLANEOUS		
554	American Photocopy Equipment Co.	Photocopying machine	97

standardize on standard

HALLOWELL

SOLID STEEL COLLARS

now size-marked for easy identification

42 stock sizes—each marked with shaft diameter for easy identification—are now available at your HALLOWELL distributors'. And these precision machined solid steel collars—in sizes from ⅜" to 3" inclusive—have the famous self-locking UNBRAKO Socket Set Screw to assure positive positioning on the shaft.

Write for literature and the name of your nearest HALLOWELL distributor. STANDARD PRESSED STEEL Co., Jenkintown 39, Pa.

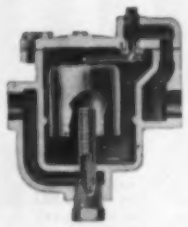
HALLOWELL POWER TRANSMISSION DIVISION

SPS

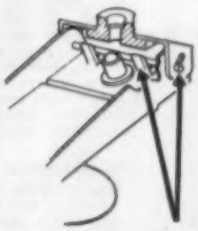
JENKINTOWN PENNSYLVANIA

Circle 558 on Reply Card for more data

NEW TRAP



Sarco *Camlift* Bucket Trap



Cams lever valve off seat; slot and pin provide maximum valve opening

handles more volume in less time!

Sarco uses the principle of the fulcrum and lever in this newly designed trap and gives you greater discharge at no increase in trap size. Result: more for your steam trap dollar.

It's all made possible by the Sarco *Camlift* valve mechanism which provides the force needed to open the large valve without a corresponding increase in trap size.

See for yourself how this small inverted bucket trap gives you maximum capacity.

Write for free trial trap giving pipe size, capacity, and pressure conditions.

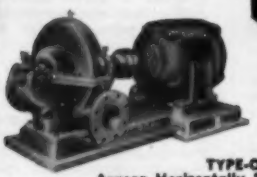
SARCO COMPANY, INC.

EMPIRE STATE BUILDING, N. Y. 1, N. Y.

Circle 560 on Reply Card for more data

Member of a Great Pump Family

There is a PUMP by *Aurora* for every pump job.



TYPE-OD
Aurora Horizontally Split-Case, Double Suction, Single Stage Centrifugal Pump.

For general water supply for municipalities, industries, office buildings, institutions—also—for handling liquids, chemical solutions, oils etc., in a wide variety of industries. Write for Bulletin 105-M for further details.

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

DIVISION OF THE NEW YORK AIR BRAKE COMPANY
42 LOUCKS ST., AURORA, ILL.

Circle 559 on Reply Card for more data

U.S. TOTALLY-ENCLOSED *Explosion-Proof* MOTORS

SAFE *for dangerous damp and dusty locations*

Class I—Group D
Class II—Groups F G
with or without fan

Request Bulletin

U.S. ELECTRICAL MOTORS, Inc.

BOX 2058, LOS ANGELES 54, CALIFORNIA MILFORD, CONN.

Circle 561 on Reply Card for more data

bulletins

. . . for listing of the bulletins just received see page 35

AIR FILTERS & DUCT COLLECTORS

228—Dust Collectors

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrestor types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented by means of illustrated industrial installations. Kirk & Blum Mfg. Co.

229—Industrial Dusts

"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors which influence choice of equipment, and explains the operation of each type of collector. Buell Engineering Co., Inc.

230—Dust Collectors and Arrestors

Series of four folders describes cyclone type collector and portable, standard, and automatic bag-type dust arrestors. Also includes 32-page catalog describing exhaust fans for dust collecting and air handling. Northern Blower Co.

231—Electrical Precipitator

Electrical precipitator may be used for removal of practically any solid or liquid suspended in a gas, according to 28-page brochure 195C. How it works, basic types and advantages are illustrated and discussed. Numerous specific installations are given. Research Corp.

232—Industrial Dusts

Twelve page booklet 3-TTC-1 gives a comprehensive background of modern dust problems and an approach to their solution. Discussed are sources of dust, determining dust sizes, prediction, flyash emission codes, types of dust and methods of control. Diagram shows distance of dust travel from source. Methods for plotting dust particle size are illustrated. The Thermix Corp.

233—Tubular Dust Collectors

Six booklets, 3-PDC-1, 2 and 2-PDC-1 through 4, on mechanical dust collectors cover capacities and efficiencies, dimensions, construction and the decantation method. Latter method is used on installations where reinjection of large, unburned high carbon particles is required. Separation from flyash is accomplished in a single unit. Prat-Daniel Corp.

234—Electrical Precipitators

Ten booklets, 2-ATC-1 through 9, cover the history and fundamentals of electrical precipitators, design and construction, dimensions and capacities, electronic power supply, selenium power supply, and installation stories. They also provide an up-to-date discussion with illustrations of the latest development in electrical precipitation. The Aerotec Corp.

BOILERS & BOILER ACCESSORIES

235—Steam Generators

The advantages of shop-assembled power for your plant with Type-A water tube steam generators are explained in 8-page bulletin 52-1. Line drawings show the flexibility of design possible and dimensions. The Wickes Boiler Co.

236—Draft Inducers

The biggest contribution to the cause of improved furnace operation in recent years has been the mechanical draft inducer, according to 12-page booklet I-52. Six causes of poor chimney draft are listed. Parts of a typical draft inducer installation are numbered and explained. A selector chart is included. L. J. Wing Mfg. Co.

237—Packaged Steam Generators

Construction of packaged steam generators is described in eight-page bulletin 1050. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room is given. Ames Iron Works.

238—Pressure Equipment

One of the country's oldest manufacturers of equipment and accessories for plants piping steam, air, and gas under pressure, has published catalog 400, covering its line of separators, traps, and boiler trim. A condensation of the information in catalogs 500, 600, and 700, the booklet gives adequate size and pressure tables and technical data on the most frequently and commonly used equipment. Wright-Austin Co.

239—Boiler Baffles

"More Steam from Your Boilers," a four-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indicate how they are installed in each specific unit to secure crossflow of gases. The literature also points out how gas passes are tapered in area to obtain necessary velocity for maximum heat transfer. The Engineer Co.

240—Boiler Replacement

"What Every Business Man Should Know About Boilers," has been prepared to give executives a better understanding of boilers and a realization of the tremendous loss that industry is taking due to obsolete and inefficient steam generating equipment. Chances are two to one that your boiler is obsolete, according to this 14-page booklet. The term "packaged steam generator" is explained along with the advantages of using such units. Superior Combustion Industries, Inc.

241—Soot Blowers

Bulletin 1137 gives complete information on the Model G9B blower which employs a fixed position rotating element to clean a large number of tubes by sweeping through a pre-determined arc. The bulletin suggests the various uses for boilers, superheaters, reheaters, economizers, heat exchangers, and oil stills. The blower described is available for three pressure ranges up to and including 1500 psi. Diamond Power Specialty Corp.

242—Fuel Systems

Over 50 years of experience in steam generation backs up 29-page bulletin "Pulverized Fuel Systems." Well illustrated with cross-sectional drawings and graphs, it gives advantages, typical installations, and descriptions of major operating parts. Foster Wheeler Corp.

243—General Catalog

A wealth of research, engineering, and manufacturing experience, gained since the founding of this company in 1880, is incorporated in the products described in four-page folder. Steam generators, heat transfer equipment, pressure vessels, valves, and fittings, and refrigeration equipment are shown. Henry Vogt Machine Co.

244—Coal-Burning Installations

"Burning Bituminous Coal the Modern Way," contains 24 pages of case histories from industries of all sizes and types. Engineering survey results for equipment such as boilers, stokers, coal and ash handling units, and automatic controls, include annual fuel consumption and operating costs. Bituminous Coal Institute.

245—Packaged Boilers

Powermaster packaged automatic boilers in seventeen sizes from 15 through 500 hp for steam process as well as steam and hot water heating service are described in a four-page folder. It lists the advantages of packaged automatic boilers contrasted with equipment of conventional design. The firing equipment for light and heavy oils as well as gas is described for this

PRODUCT INDEX

Air Filters & Dust Collectors 102
Boilers & Boiler Accessories 102
Building Materials & Maintenance 104
Electrical Equipment 104
Engines & Turbines 104
Fans & Blowers 105
Filters, Strainers, & Purifiers 105
Heat Exchangers & Water Heaters 105
Heating, Air Conditioning & Refrigeration 106
Instruments & Controls 106
Lubricants & Lubrication Equipment ..106
Materials of Construction 106
Materials Handling Equipment 106
Mechanical Power Transmission 107
Packings & Gaskets 107
Pipe, Tubing & Hose 107
Pumps & Compressors 108
Refractories & Insulation 108
Steam Specialties 109
Valves & Regulators 110
Water Treatment & Waste Disposal 111
Miscellaneous 111

NOTE—Each bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 34/35 & 98/99.

company's Voriflow air-atomizing oil burner and pre-mix gas burner designs. Installation photographs emphasize various fuel firing arrangements. Orr & Sembower, Inc.

246—Boiler Service Valves

Surface blow, bottom blow-off, water column blow-off, and connections are covered in 22-page bulletin E125, with complete specifications, materials, and dimensions of each type. Valve operation is explained by illustration. Fire protection valves are included. Everlasting Valve Co.

247—Boilers

Self-contained boilers for heating and processing are described in seven-page bulletin AD-100. Design is illustrated by a cross-sectional drawing and efficiency is shown by graph. Capacity and dimension tables are included. Cleaver-Brooks Co.

248—Firing Equipment

Over 30 years of leadership in the manufacture of industrial-commercial firing equipment is reflected in 19-page general catalog 3048. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included among the many illustrations. Specifications and detailed data on exclusive features of this company's oil, gas, and combination oil-gas burners are given. Petro Division.

249—Cyclonic Combustion

Principles of the patented method of Cyclonic Combustion are explained in four-page folder, "All Your questions Are Answered by Cyclotherm." Descriptive drawings show how air is introduced into the combustion chamber at extremely high speeds in a revolving spiral vortex, radiating heat to the fire tube through direct radiation and convection. Cyclotherm Division of United States Radiator Corp.

250—Heavy-Oil Burners

Booklet 175-G, eight pages, describes the outstanding design and construction features of both the Model B oil, and the Model BR oil-gas burners, including dual-pump reservoir, fuel regulator, high-speed belt-drive, precision air-oil control, sure-fire ignition, fuel feed to atomizer, and extra long nozzle. Complete specifications, computed at 70 percent thermal efficiency, are given for both types. Preferred Utilities Manufacturing Corp.

251—Automatic Burner

Newly designed automatic burner, model PK-54, for oil, gas, and oil or gas, is described in four-page folder 430. Safety features are listed and the unit's integrated design is explained. For capacities to 42,000 lb steam per hour, the burner is described as a complete, automatic combustion unit including burner, blower, and controls. Peabody Engineering Corp.

252—Boiler and Equipment

Sixteen-page bulletin SB-50, "Erie City Boilers and Allied Equipment," describes custom designed steam generators for central station or industrial application. A number of water tube types available as well as a line of fire tube waste heat units are pictured in cross section. Erie City Iron Works.

253—Water Gages and Columns

How the Bi-Color water gage operates to show actual water level without transmission by mechanical, electrical, or hydrostatic means is explained in 23-page bulletin 1051. The many types of gages and their installation are pictured. High-low water alarms, soot blowers, and the "Utiliscope" wired television unit are also described. Diamond Power Specialty Corp.

254—Liquid Level Gages

Remote reading liquid level gages to protect boilers, deaerating tanks, feed

For DOUBLE BOILER BLOW-OFF SAFETY

These EVERLASTING Duplex Boiler Blow-Off Units are assuring double safety in plants all over the country.

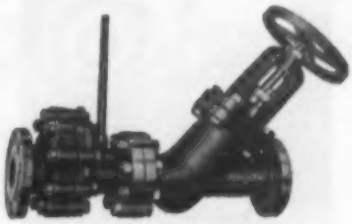
In the unit illustrated above, the left-hand valve is the standard quick-operating EVERLASTING design which opens with a quarter-turn of the lever and closes with a drop-tight seal that actually improves with use. The right-hand valve is an EVERLASTING Angle Valve, stoutly built to withstand shocks and abrasion of blow-down solids.

Below are shown two additional EVERLASTING Duplex Units, each including the EVERLASTING "Y" Valve . . . simple and sturdy in design, with all parts interchangeable with those of the Angle Valve.

All EVERLASTING boiler blow-off designs conform with ASME codes, and are available in a range of sizes for pressures up to 600 psig.

Write for descriptive bulletin.

Two of the many available combinations of EVERLASTING Boiler Blow-Off Units



EVERLASTING VALVE CO., 41 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF.

EV-272

FOR EVERLASTING PROTECTION

Circle 562 on Reply Card for more data

bulletins

— Starts on page 102

water heaters, and storage tanks are described in eight-page bulletin 176. A typical schematic drawing of a steam boiler application shows the gage in use. Drawings also illustrate wall and panel mounting. Jerguson Gage & Valve Co.

255—Industrial Television

In many high pressure steam plants there is a need for televising boiler water level gages so that readings may be viewed at more convenient locations. Recognizing this need, this company offers four-page bulletin W6-1813 describing RCA's industrial TV installation which is recommended for use with Yarway Flat-Glass Water Gages. Yarnall-Waring Co.

BUILDING MATERIALS & MAINTENANCE

256—Iron Cements

Suggestions for simple reliable repairs on equipment and piping using iron cement are presented in 40-page pocket-size pamphlet. Patching cement, aluminum and bronze cement, concrete paint, gaskets and clamps are also presented. Also included is a folder describing advantages and how to apply concrete paint No. 15, for interior or exterior use. Smooth-On Manufacturing Co.

257—Thread Compound

A data sheet gives complete information on C-5 "Hi-Temp" thread compound. A sample will be sent along with the data sheet. Felt Products Manufacturing Co.

258—Maintenance Book

"Genius at Work," is a handy booklet full of ideas for plant maintenance. This company has developed Kroil, a chemical for loosening frozen parts. Kano Labs.

259—Flooring

"Hand Book of Building Maintenance," gives valuable information on keeping your plant in efficient working order. Instant-Use concrete floor patch is described with suggestions for its use, along with other materials for repairing floors. Flexrock Company.

260—Pipe Joint Compound

With the literature on this waterproof sealer for pipe joints carrying water, gas, or low-pressure steam, a sample of the compound will be sent. Key Company.

ELECTRICAL EQUIPMENT

261—Variable Speed Motors

How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed. U. S. Electrical Motors, Inc.

262—Fuses

Hi-Cap fuses for the protection of loads above 600 amp are described in six-page bulletin HCS. Two handy charts are included: Current Limiting Effect and Opening Time Curves. Use of these fuses in conjunction with Fusetron fuses is explained. Bussmann Manufacturing Co.

263—D-C Power

D-c power sources and supplies are described in eight-page booklet B-1040. Mechanical and electrical specifications are given for the Nobratron. Sorensen and Company, Inc.

264—Motors

Advantages of the various types of motors made by this company are given in four-page folder 23. Descriptions of single-phase and polyphase motors are included along with a listing of their specifications. Wagner Electric Corp.

265—Flexible Conduit

Extra flexible Sealtite conduit for electrical wiring of machine tools and industrial equipment is pictured and described in four page pamphlet EF-531. It points out the fact that this liquid-tight, extra flexible conduit is approved for these uses by the Joint Industry Council. American Metal Hose Branch, American Brass Co.

266—Circuit Breakers

"What You Should Know About Circuit Breakers," 16-page manual 101, explains the operating principles of basic circuit breaker design. Included are simplified diagrams of three basic types. Explanations, charts and diagrams deal with temperature factors, inrush current effects, tripping and reset time, quick and slow make-and-break, and wire deterioration rates. Heinemann Electric Co.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pgs. 34/35 & 98/99. Your requests will be handled promptly.

267—Communication Systems

This data kit describes low-cost communication networks which make it possible to talk from control points to plant and between plant sites. Ease of installation is described along with the many possible arrangements for specific needs. Farmers Engineering and Mfg. Co.

268—Metal Clad Switchgear

The HV line of metal clad switchgear is described in bulletin 7004B. Advanced engineering, refined design, and quality construction are included in this line according to the bulletin. I-T-E Circuit Breaker Co.

269—Outdoor Service Equipment

Designed to make easier the selection of outdoor service equipment, 12-page bulletin 2016 combines descriptive data on all available standard equipment—service entrance, receptacle type, dual control, three-phase units. Typical assemblies of circuit breakers and the various enclosures are listed for each type of equipment. Heinemann Electric Co.

ENGINES & TURBINES

270—Steam Turbines

Fully-illustrated 24-page bulletin 1961 emphasizes the flexibility of design of the type-S turbine which is said to make possible selection of the proper number of stages, governor, and controls to give maximum efficiency for your steam and operating conditions. Each component of the system is pictured and described. Worthington Corp.

271—Multi-Stage Turbines

Smaller framed, multi-stage turbines are featured in six-page bulletin. Overspeed governor, governor valves, blades, dia-

Increase machine performance with LOVEJOY Variable Speed PULLEYS

Quickly, easily installed on old or new machines . . . allowing infinitely variable speed adjustments over wide range. A mere turn of hand instantly, accurately speeds up or slows down the driven unit for **changes in production schedules . . . adjustment for operator ability . . . corrections for size or stock, temperature or humidity, size or density.**

Available in 8 sizes—fractional to 8 hp. with ratios to 3 to 1.

Write today for illustrated catalog and complete technical data.

LOVEJOY FLEXIBLE COUPLING CO.

4843 W. LAKE STREET • CHICAGO 44, ILLINOIS
ALSO MFRS. OF UNIVERSAL JOINTS AND FLEXIBLE COUPLINGS

Circle 563 on Reply Card for more data

grams, and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

272—Steam Turbines

Full details of this company's steam turbine are given in bulletin 135. Drawings and installation photographs point out the special features. How to save operating and maintenance costs by buying the right size for individual needs is explained. Coppus Engineering Corp.

FANS & BLOWERS

273—Propeller Fans

Three new models are among the 13 types of fans shown in 40-page bulletin A-109. It also describes three types of roof ventilators, unit heaters and intake air units, and includes specifications, dimensions, and performance figures on all of the equipment plus valuable engineering data. A special feature is a discussion of corrosion-resistant materials and coatings which includes a table showing the suitability of special materials and coatings for use for a wide variety of fumes commonly encountered in industrial installations. Hartzell Propeller Fan Co.

274—Axial Fans

This 35-page catalog, B-1013, is designed to acquaint the user with axial fans. Technical data furnished permits the proper selection of types and sizes. Physical dimensions are shown to assist in preparation of preliminary layouts. American Blower Corp.

FILTERS, STRAINERS & PURIFIERS

275—Separators & Purifiers

Live steam, exhaust steam, air and gas, and receiver type separators, and steam purifiers and exhaust heads are described in 24-page catalog 500. Charts give pressure drop, steam capacity, and air capacity. Wright-Austin Co.

HEAT EXCHANGERS & WATER HEATERS

276—Temperature Control

A simple method of controlling the temperature of liquid or gas is explained in four-page folder 120 on heat exchangers. Cutaway drawings illustrate how the units operate and flow diagrams show how controls keep a fluid at uniform temperature. Niagara Blower Co.

277—Heat Transfer Equipment

Various types of heat transfer equipment are among the products described in 12-page catalog 12. Also presented are various types of dry blending equipment and such process equipment as kettles, evaporators, vessels, reactors, and coils. The Patterson-Kelley Co., Inc.

278—Water Heaters

A streamlined system of heating water and process liquids quickly and at low cost is explained in this bulletin. The Instant Heater described eliminates the need for reducers. Cross-sectional drawings explain how the unit operates. Johnson Corp.

347—Heating Specialties

How to design a one-pipe hot water system is explained in eight-page booklet J-355. In addition to discussions, data tables and diagrams are included. Many types of heating specialties are described, including a circulator, flow valves and fittings, relief valves, vents, a charging valve, compression tank. The Trane Co.

NON-FLUID OIL
TRADE MARK REGISTERED

PREVENTS LEAKY OVERHEAD CRANES

Oil deposits on stock and consequent cleaning costs can be eliminated by using NON-FLUID OIL. Here's an example: On sheet metal products, it is virtually impossible to remove oil spots in the pickling process or even when the sheets are annealed. On all production lines, oil leakage and showering from overhead crane equipment also result in more frequent lubrication which runs up your lubricant and application costs.

Yes, you want shower-proof, leak-proof NON-FLUID OIL because it saves time and money. All-out lubrication plus clean end products add up to economical NON-FLUID OIL.

Send for instructive bulletin and free on-the-job testing sample of NON-FLUID OIL.

NEW YORK & NEW JERSEY LUBRICANT COMPANY
292 Madison Ave., New York 17, N. Y. • Works: Newark, N. J.

WAREHOUSES: Birmingham, Ala. • Atlanta, Ga. • Columbus, Ga. Charlotte, N. C. • Greensboro, N. C. • Greenville, S. C. • Chicago, Ill. Springfield, Mass. • Detroit, Mich. • St. Louis, Mo. • Providence, R. I. Also represented in other principal cities.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 564 on Reply Card for more data

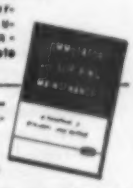
Keeps motors running like new... The easy, fast way to restore commutators and slip rings — WITHOUT DISMANTLING! — Substitutes low-cost prevention and correction for high-cost repair and rebuilding — COSTS LITTLE, SAVES A LOT.

RESURFACERS
Refinish commutators and rings to like-new condition even when ridged, scored or burned.

MICA UNDERCUTTERS
Stop sparking — help commutation — prolong brush life. For all sizes of commutators.

PRECISION GRINDERS
For more than surface smoothing—under machine's own power. Accurate to .001".

FLEXIBLE ABRASIVE
Cleans and burnishes commutators. Non-dusting. Complete size range.



FREE 39-page Handbook — Complete information on commutator maintenance. MAIL COUPON.

IDEAL Products Are Sold Through Leading Distributors

IDEAL INDUSTRIES, Inc.
1023 Park Avenue, Sycamore, Illinois
Send FREE HANDBOOK and information on
☐ Resurfacers ☐ Undercutters
☐ Precision Grinders ☐ Flexible Abrasive
NAME
COMPANY
TITLE
ADDRESS
CITY ZONE STATE

Circle 565 on Reply Card for more data

bulletins

— Starts on page 102

279—Instantaneous Water Heater

Answers to your hot water problems are given in booklet "Methods and Means." Operation and advantages of the instantaneous water heaters as compared to the indirect method heater are discussed and illustrated. Pick Manufacturing Co.

HEATING, AIR CONDITIONING, & REFRIGERATION

280—Unit Heaters

Catalog CUH 840-A gives the complete story on Grid unit heaters. Catalog BC-1040 describes Grid blast coils for process drying. How the construction of the unit heaters prevents electrolytic corrosion is explained in booklet "Corrosion in Unit Heaters." D. J. Murray Manufacturing Co.

281—Air Conditioner

Precision control of air temperature and moisture enable you to produce your product in any climate, at any season, according to six-page bulletin 122. The Type "A" air conditioner described, for drying or moistening of air, is shown in typical installation photographs. A cross-sectional drawing points out operation and advantages of unit. Niagara Blower Co.

282—Electric Heating

Industrial electric heating applications and methods are described in 32-page booklet, "101 Ways to Apply Electric Heat." Illustrated case histories show experience-tested ways to apply metal-sheathed Chromalox electric heating units in various industrial jobs. Physical aspects of installation are shown along with a description of the problem, solution, and advantages obtained. A section is devoted to far-infrared heating, showing 28 typical uses. Edwin L. Wiegand Co.

INSTRUMENTS & CONTROLS

283—Instrumentation

Illustrated eight-page booklet R-8, "Results," presents the case history of a large independent electric power producer. In addition to discussions of the use of steam, fuel and ash handling, and plant steam demand, the combustion control system is fully described. The Hays Corp.

284—Flow Meters

With an alarm control, the flow meters described in this bulletin have only three moving parts. How it operates to ring a bell, light a light, or activate a motorized valve is explained by means of illustrations. Henszey Co.

285—Level Control

Bulletin PC-37 describes floatless level control unaffected by surface agitation or equipment vibration. Drawings show typical installations and details of operation. Leslie Co.

286—Gages & Thermometers

Large variety of recording, dial indicating, transformer and freezer thermometers and pressure, vacuum and compound recording gages fully described and illustrated in eight-page bulletin G13C. Also four pages of operating instructions for recording gages, and complete price list. Electric Auto-Lite Co., Instrument & Gauge Div.

LUBRICANTS & LUBRICATION EQUIPMENT

287—Lubricating Oil

Excellent time-temperature characteristics, and application by any method are advantages listed in technical data sheet 17, for newly developed lubricating oils. Physical properties and other advantages are discussed, and a chart shows service life characteristics. Sun Oil Co.

288—Oil Reclaimer

Subject of four-page folder R-247 is a self-contained, compact oil reclaimer for keeping industrial oils free from contaminants. In addition to describing how the process works, the bulletin suggests applications. The Hilliard Corp.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pgs. 34/35 & 98/99. Your requests will be handled promptly.

289—Lubricant

This instructive bulletin explains the uses and advantages of Non-Fluid Oil. According to this booklet, it cannot clog fittings, it lubricates until entirely consumed, and will not separate under pressure. A free testing sample of the oil will be sent with the literature. New York & New Jersey Lubricant Co.

290—Lubricator

Automatic force feed lubricator Model "94" described in 11-page booklet 94-C will pump against any steam or air pressure up to 1500 lb and will handle any grade of oil, from the lightest mineral to the heaviest cylinder stock. Models are shown for air and ammonia compressors, for feeding two kinds of oil, and for slow and high speed machinery. Manzel Div. of Frontier Industries.

MATERIALS OF CONSTRUCTION, FABRICATION

291—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in two bulletins. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

292—Steel Weldments

New close-tolerance machinery illustrated in this four-page folder makes it possible for this company to produce single components or complete assemblies to your plant's specification. Examples of equipment designed and engineered by this company are also given along with suggestions as to cast parts that can be replaced by fabricated steel weldments. The Foster Co.

MATERIALS HANDLING EQUIPMENT

293—Conveyor System

How a recently installed interfloor-conveyor system cut receiving-to-storage time is discussed in a reprint. The article tells how the system eliminated a long truck haul, stopped elevator congestion, and reduced unloading time of highway trucks. Included are descriptions of the vertical interfloor conveyor, feeder conveyor, take-away conveyor, and automatic control system. Gifford-Wood Co.

Engineered for...

Positive, Tight Closure—even air or bubble tight.
Automatic Control—electric, air, hydraulic, float, solenoid, etc. Or manual control, if desired.
Pressures—to 300 p.s.i. and higher.
Temperatures—from sub-zero to 2000° F.
Materials—made of any metal or rubber lined.
Sizes—from 1" to 120" diameter, and larger.

We also manufacture wafer type butterfly valves; slide and gate valves; proportioning valves; swing check valves. Write for Catalog.

W.S. ROCKWELL VALVES

W. S. ROCKWELL COMPANY
2304 Eliot Street • Fairfield, Conn.

Butterfly valve with outboard roller bearings, electric motor operator and auxiliary handwheel control, for high velocity air at 125 p.s.i. and temperatures from minus 20° to plus 200° F.

Circle 566 on Reply Card for more data

294—Coal Handling Equipment

Applications of coal handling equipment for the power plant, pictured in 40-page brochure 2410, illustrate the cumulative experience gained in thousands of installations over more than 75 years. Drawings show tested layouts for various operating conditions. Link-Belt Co.

295—Belt Conveyor Design

Engineering data required to design a belt conveyor for any application are presented in 86-page catalog 852. The booklet, published to serve as a handbook on conveyor design, states that many problems can be answered by using a standardized unit. These units have been indexed and classified to simplify selection. The Jeffrey Mfg. Co.

MECHANICAL POWER TRANSMISSION

296—V-Belts

Fractional horsepower V-belts, for use in servicing light duty applications, are cataloged according to the new industry-standard numbering system. Various types of machines are listed alphabetically by company or trade names for convenience in determining the proper belt. Manhattan Rubber Div., Raybestos-Manhattan, Inc.

297—Steel Collars

Steel shaft collars are shown in use on industrial lift trucks, printing presses, textile machinery, and other industrial equipment. Advantages of this type of collar are listed and a specification table is included. Standard Pressed Steel Co.

298—Eddy-Current Machinery

"Basic Principles of Eddy-Current Machinery," a section of 16-page bulletin GB1, explains the fundamental principles of generating torque by means of eddy-current devices. Another section, "Characteristics of Rotating Equipment," contains engineering data. Descriptions are included of typical eddy-current equipment such as adjustable speed drives and couplings. Dynamatic Corp.

299—Rayon Belting

Transmission belting with rayon instead of cotton plies was proved in field applications for more than four years on jobs specially selected for their severity according to four-page folder A5163W. Uses and advantages of the several types of Thor belting are listed. Goodyear Tire & Rubber Co.

PACKINGS & GASKETS

300—Packings

Darcova pumcups, which permit equipment to be operated at reduced speeds, are described in two bulletins: No. 4502 on Pumcups for air or hydraulic mechanisms; and 4401 on units for reciprocating pumps. How these units decrease maintenance and lower operating costs is described. Darling Valve & Mfg. Co.

PIPE, TUBING & HOSE

301—Prefabricated Conduit System

Introduced in four-page folder 5210 is a newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. Also included are traps, valves, and expansion devices. The

need information on
material handling equipment?

reach for your
Plant Engineering File

"...a great time-saver"

These manufacturers' catalogs are instantly available in Section 1A of your Plant Engineering File:

Allied Steel & Conveyors, Inc.	Forker Corp.
American Monorail Co.	Hough, Frank G. Co.
Baker-Raulang Co.	International Nickel Co.
Barber-Greene Co.	Lewis-Shepard Products, Inc.
Bassick Co.	Link-Belt Co.
Beacon Machinery, Inc.	Mechanical Handling Systems, Inc.
Big Joe Mfg. Co.	Rapids-Standard Co.
Buell Engineering Co.	Richards-Wilcox Mfg. Co.
Chisholm-Moore Hoist Corp.	Sauerman Bros., Inc.
Clark Equipment Co.	Standard Conveyor Co.
Cleveland Crane & Engrg. Co.	U. S. Rubber Co.
Faultless Caster Corp.	Wright Hoist Div.

In other sections of the File you will find additional catalogs containing useful information on a wide range of products used in the maintenance of all plant facilities.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
119 West 40th Street,
New York 18, N. Y.

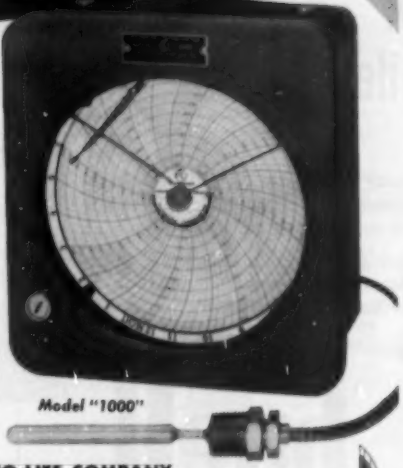
Circle 568 on Reply Card for more data

AUTO-LITE

TEMPERATURE RECORDING...

Newly designed, Model "1000" Auto-Lite Recorder gives permanent proof of temperature behavior. • 6" clear reading chart; various standard ranges from minus 40°F. to plus 550°F. • 3 standard types; choice of 24-hr. or 7-day cycle. • Electric or mechanical chart drive. • With capillary tubing for remote reading. Priced from $49.50.

Send for new catalog describing many styles of Auto-Lite temperature Recorders and Indicators.



Model "1000"

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

TEMPERATURE RECORDERS

Tune in "SUSPENSE!"...CBS Radio Mondays... CBS Television Tuesdays

Circle 567 on Reply Card for more data

bulletins

— Starts on page 102

literature explains how the system is installed and stresses simplicity of making joint connections. The Ric-wiL Co.

302—Pipeline Expansion

Catalog 135, 24 pages, is packed with engineering applications and selection data necessary to the proper solution of pipeline expansion problems. The center spread is devoted to a schematic piping layout illustrating expansion joint application and principles. Flexonics Corp.

303—Flexible Metal Hose

For what purpose do you use flexible metal hose? Whatever your application, you will find valuable information about job tested and certified hose in catalog 900. Included are data on steel, stainless steel, monel, and bronze hose in sizes 1/3 to 36 in. ID. Atlantic Metal Hose Co.

304—Pipe Hangers

This hanger catalog describes the complete line of adjustable pipe hangers and supports made by this company. Specifications, drawings, and engineering data are included. Grinnell Company,, Inc.

305—Couplings

Flexible couplings which never require lubrication are shown in 1-page bulletin 1009. Valuable engineering data for each type of coupling are given in table form along with drawings and application recommendations. Two more tables give conversion data for varying or pulsating load and for horsepower to torque. Lovejoy Flexible Coupling Co.

PUMPS & COMPRESSORS

306—General Catalog

Equipment for buildings and institutions is the subject of 20-page bulletin WP-1099-B27M. Condensed information is provided on such equipment as air conditioning and refrigeration products; oil, gas and dual fuel engines; deaerators and de-aerating heaters, water conditioning, steam turbines and turbine generators; liquid meters; centrifugal pumps; regenerative turbine pumps; vertical turbine pump; and multi-V drives. Worthington Corp.

307—Opposed Impeller Pump

How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacitors to 1,000 gpm, pressures to 1200 psig, and temperatures to 350 F. Typical applications are tabulated. DeLaval Steam Turbine Co.

308—Pump Valves

Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

309—Turbo Pump

Each component of the type DE turbo pump is pictured and its design advantages explained in a six-page folder. The lubrication system is also described in detail. Typical uses are listed. The J. S. Coffin, Jr., Co.

310—Proportioning Pump

An explanation of the operation and advantages of reciprocating mechanical drive metering and proportioning pumps is given in 20-page brochure UP-52R. Technical information on how to select the proper unit as well as service recommendations for handling over 300 substances is presented. Hills-McCanna Co.

311—Compressors

Two-stage air-cooled compressors for stationary or semi-portable use are described in 11-page bulletin 750. Photographs and cross-sections point up the special features of the units which are arranged for belt-drive, coupled, or "built-in" motors. Chicago Pneumatic Tool Co.

312—Non-Clogging Pumps

Type U non-clogging pumps designed for handling liquids carrying large amounts of solids and foreign materials are described in 11-page bulletin 730-C. The specific uses of each type pump are given along with tables to help in selection. Cross-sectional drawings are used to present special features of different types. Weinman Pump Manufacturing Co.

313—Pump Package Systems

This catalog describes pump package systems including welded steel tanks in standard sizes of 50, 100, 175, 250, and 500 gal complete with all accessories. The Manajust Stroke adjustment for varying capacity when pump is not operating, and the Autajust for precise control of flow while pump is running are explained. Orchem Pump Div.

314—Pumps

Condensed catalog "M" describes pumps for every purpose. Among those described are: turbine type pumps for use with small capacities and high heads; and type 66U side suction centrifugal pumps. Aurora Pump Co., Div. of New York Air Brake Co.

315—Compressors

Horizontal heavy duty air and gas compressors, Type T, are described in 15-page bulletin 728-B. Cross sections of crankshaft, inlet valve unloading system, compressor cylinder and valves, and the complete compressor add to the value of the booklet. Also included are brief descriptions of other arrangements. Chicago Pneumatic Tool Co.

316—Chemical Feeders

Install Series 50-T chemical feeder on your boiler feed-water pumps and you can forget troubles due to guesswork, inaccuracy or forgetfulness according to four-page folder 5M. Units for every requirement are pictured. Flow diagrams explain operation and advantages. Manzel Div. of Frontier Industries.

351—Vertical Pumps

"Vertical Pumps for Volatile Fluids," six-page folder 1026, appraises the advantages of vertical turbine pumps for handling such liquids as gasoline, diesel fuel, crude oil, L-P gases, and ammonia. Efficiency curves also are included. Johnston Pump Co.

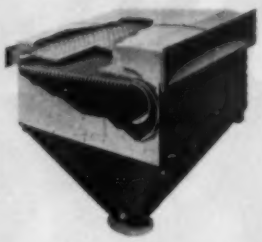
REFRACTORIES & INSULATION

317—Refractories

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. Important information including recommendations for each is presented. Photos depict application and end results. The Babcock & Wilcox Co., Refractories Div.

For Larger-Boiler Fly Ash Collection and Valuable Dust Recovery

Buell-designed 'LR' Collector Stops Fly Ash From Small Boilers!

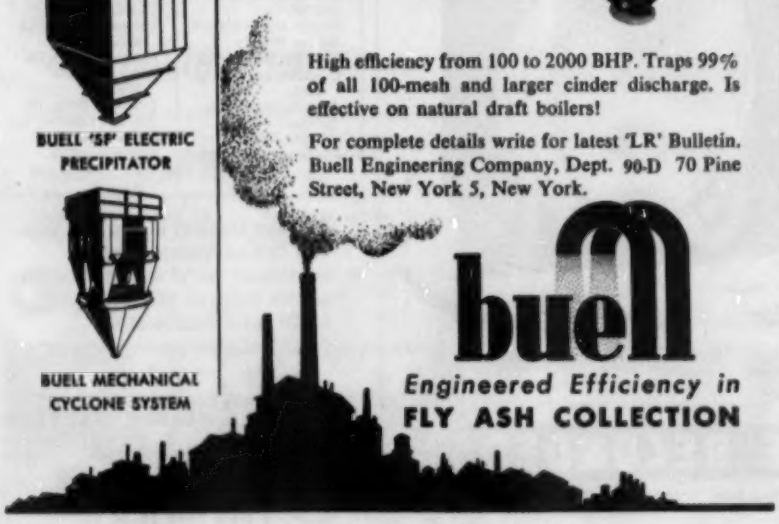


BUELL 'SP' ELECTRIC PRECIPITATOR

BUELL MECHANICAL CYCLONE SYSTEM

High efficiency from 100 to 2000 BHP. Traps 99% of all 100-mesh and larger cinder discharge. Is effective on natural draft boilers!

For complete details write for latest 'LR' Bulletin. Buell Engineering Company, Dept. 90-D 70 Pine Street, New York 5, New York.



buell

Engineered Efficiency in FLY ASH COLLECTION

Circle 569 on Reply Card for more data

318—Refractories & Insulation

Catalogs R-52 through I-93, compiled in a binder, form an illustrated 40-page booklet showing where, when, and how to use various types of materials for industrial heat generation and processing equipment. An index is included for quick reference.. Refractory & Insulation Corp.

319—Heat Resistant Concrete

Useful engineering data and information pertinent to the structural design of refractory and heat-resistant concrete is contained in illustrated 12-page booklet PP-5M. Subjects such as strength, volume changes, methods of reinforcing, sprung arches and domes, application to ducts, and stack linings are dealt with. Universal Atlas Cement Co., Lumnite Div.

320—Industrial Insulation

"J-M Products for the Process Industries," eight pages, is arranged as a ready reference for men responsible for the design, installation, and operation of process equipment. It gives concise data on the properties of the various products and includes photographs showing typical installations. Johns-Manville Corp.

STEAM SPECIALTIES

321—Thermostatic Steam Traps

Balanced pressure thermostatic steam traps for pressures to 300 psi and capacities to 36,500 lb condensate per hr are discussed in four-page folder 250-A. Construction details, operating principle, advantages and maintenance are discussed and illustrated with photos and cutaways. Screwed strainers are also briefly presented. Sarco Co., Inc.

322—Trapping Practice

Engineers concerned with steam traps should find 48-page catalog J a valuable source of data on recommended trapping practice. In addition to explanation of how to calculate condensate loads and select traps, a maintenance section covers installation, preventive maintenance, trouble shooting, and repair. Armstrong Machine Works.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pgs. 34/35 & 98/99. Your requests will be handled promptly.

323—Steam Traps

Catalog 68G, 31 pages, describes and illustrates steam traps, strainers, regulating and reducing valves, separators, and vacuum and lifting traps. Included are applications, dimensions, and a handy steam properties table. Strong, Carlisle & Hammond Company.

324—Welded Floats

Units made of stainless steel, monel, and chrome plated steel, in spherical, eliptical, and cylindrical shapes are shown in eight-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

PULSOLATOR

The Automatic Lubricator that can be 400 places at once as often as 20 times a minute

Yes, Pulsolator can dependably lubricate as many as 400 bearings with a controlled quantity of oil, as frequently as 20 times a minute, through a single system with loop line up to 300 feet.

Here is your answer to reliable, automatic lubrication for machine tools, printing presses and similar equipment where the higher pressures of force feed systems are not essential. Pulsolator can save you money by eliminating oil waste and repairs and down time that come from lubrication failures resulting from human oversight or neglect.

Systems with various capacities and with both gravity and pressure feeds are adaptable to an endless variety of applications. Let experienced Manzel engineers show you how Pulsolator automatic lubrication can lower your costs and speed production efficiency Write:

Manzel

DIVISION OF FRONTIER INDUSTRIES, INC.

320 BABCOCK STREET BUFFALO 10, N. Y.

Circle 570 on Reply Card for more data

More inches of VISIBILITY . . . and No Blind Spots with NEW Jerguson STEAM GAGES

Assembly No. 618

You get more inches of visibility within centers available . . . and no blind spots with the New Jerguson Steam Gages with the horizontal expansion loop. The special new compact valve, with a *horizontal* loop that keeps the strain off the gage assembly under varying conditions of expansion and contraction, gives you maximum gage room within the centers.

The special offset single piece gage chamber design with staggered glasses and covers gives you continous visibility of the water level *with no blind spots* between gage sections.

The gage can be turned at any angle, yet there are no stuffing boxes between gage and valves. The ingenius design of the assembly includes a bracket so the gage will always stay in vertical position. The OS&Y valves have renewable seats and are standard with quick closing stem for chain operation, as shown, or available with plain closing stems and chain wheels.

Made in three designs of single piece chamber: for one, two, or three section glass for any W.S.P. Any Jerguson standard gage may be supplied with stems and flanges for use with this expansion loop valve.

Write for full information on Jerguson New Steam Gages with Horizontal Expansion Loop Valves.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY

100 Fellsway, Somerville 45, Mass.

Offices in Major Cities

Jerguson Trees Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

Circle 571 on Reply Card for more data

bulletins

— Starts on page 102

325—Float Traps

If you are planning to install low, medium, or high pressure float or float and thermostatic traps, you will need this illustrated catalog sheet. According to the data sheet, once these valves are installed, there is no necessity for the breaking of any pipe connection for cleaning or repairing. All working parts are made readily accessible by removing the cover of the trap. Hoffman Specialty Manufacturing Corp.

326—Steam Trap

The Drainator steam trap with no moving parts is described in this illustrated bulletin. Advantages, such as the fluctuating gage glass which signals when the trap is functioning properly are discussed. Coe Manufacturing Co.

327—Condenser Tube Inserts

How to restore leaking condenser tubes to service by sealing off the deteriorated portion with inserts, is the subject of four-page leaflet 500. Tube cleaners, expanders, and maintenance tools are listed. Thomas C. Wilson, Inc.

328—Tube Cleaners

Bulletin 43 introduces a new geared tube cleaner for removing scale in heat exchanger and condenser tubes of ⅝ to 2½ in. ID. The unit is said to be particularly effective where conditions require low speed and extreme power. The publication describes various types of drills available for use with this unit. Other features include a flushing system which insures a cool drill while removing scale. The Airetool Manufacturing Co.

Torque Wrenches

Both inch-pound and foot-pound torquers are described in this complete 68-page catalog. Types included are for a wide range of drive sizes with plain or ratchet head. **Please send requests directly to Proto Tool Co., Dept. IP, 22762 Santa Fe Ave., Los Angeles 54, Calif., with 10c.**

329—Tube Expanders

Rolling and flaring tube expanders and operating accessories are listed in illustrated 8-page catalog 68. General information, specifications, and recommendations are included. A useful guide for ordering is also presented. The Gustav Wiedeke Co.

330—Steam Traps

Steam traps which vent air from steam units eight times faster than ordinary inverted bucket traps are described in four-page folder 1153. Complete buying information on these Super-Silvertop Heat-Kwik traps includes condensate capacities, sizes, weights, and prices. A short description of other products manufactured by the Steam Specialties Div. of this company is also given. V. D. Anderson Co.

VALVES & REGULATORS

331—Valves

The various types of valves made by this company are pictured by means of blue-print drawings, cross sections, and photographs in bulletins 500—505, 508, and 600. Complete dimensions are listed in tables. W. S. Rockwell Company.

332—Temperature Regulators

Bulletin 330 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderizing, pickling, cleaning, and rinsing solutions. The Powers Regulator Co.

333—Flow Meters

Important data on the Diaflow Meter, for measuring air flow, gas flow, and the ratio between the two flows, are presented in eight-page booklet 52-1017-37. According to the booklet, the meter in particularly well suited for industrial furnaces and sewage disposal plants. The Hays Corporation.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.

334—Regulating Valve

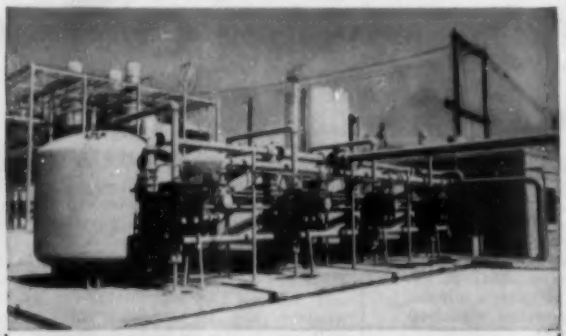
How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in four-page folder 700. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

335—Reducing Valves

Four-page folder 511-A lists actual small flow reducing valve capacities based on test data. Cross-sectional drawings show construction of the bronze and steel valves. Leslie Co.

336—Cast Steel Valves

Booklet 12-C, 56 pages, contains infor-



75000 GPH FULLY AUTOMATIC WATER TREATMENT PLANT

A Typical H & T Installation

INVERSAND SOFTENING PLANTS
INVERCARB DEALKALIZER PLANTS
PRESSURE & GRAVITY FILTERS
CONDENSATE DE-OILING FILTERS
DEMINERALIZER PLANTS
HOT ZEOLITE SOFTENING PLANTS

And a complete line of water conditioning systems. All sizes, all capacities Manual or Automatic.

New Bulletins D-F, 15-1, DM-1 & BFT-1 Available on Request

H&T SERVICE
HUNGERFORD & TERRY, INC.
CLIFTON, NEW JERSEY

Circle 572 on Reply Card for more data

with a **LIQUIDOMETER** *Tank Gauge*

- FOR GAUGING LIQUIDS OF ALL KINDS
- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

WRITE FOR COMPLETE DETAILS

THE LIQUIDOMETER CORP.
36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

Circle 573 on Reply Card for more data

mation on material specifications, preparation of welding ends, flange facings, and pressure-temperature ratings. Construction and specifications for globe, angle, and check valves in 300, 600, 900, and 1500 lb pressure classes are given. Also discussed are parabolic disk valves for hand or motor control of volume. Edward Valves, Inc.

337—Regulating Valves

Bulletin 1-A, 52 pages, gives complete information on a wide range of regulating valves for steam, water, air, gas, or oil. Illustrations, cross-sectional drawings, and specifications are included. Atlas Valve Co.

338—Valves

Catalog 10 describes List 960 and 990 valves. The 960 is for a pressure range of 2000 lb at 100 F to 380 lb at 1000 F. The 990 is for higher pressures. According to the booklet, these valves offer extra protection against excessive stress with extra-strong stem and wedge-gate connection. Champion Valve Manufacturing Co.

339—Rubber Lined Valves

This bulletin on rubber lined gate and check valves uses cross-sectional drawings to describe operation and construction. The fully revolving double disc, parallel seat principle is explained along with other advantages. Darling Valve & Manufacturing Co.

340—Solenoid Valves

Such solenoid valve specialties as single step valves, two step valves, normally open or closed valves, three and four way valves, and remote control valves are described in 20-page booklet 700. Applications, service, operation, and construction are presented for each unit. Tables list specifications. Davis Regulator Co.

WATER TREATMENT & WASTE DISPOSAL

341—Water Analysis

Published by a company engaged exclusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

342—Water Purification

"Boiler Feedwater Treatment," 19-page bulletin BFT-1, covers Inversand zeolite softeners, color process chemical softeners, and demineralizing units, including silica removal by ion-exchange. Each process is explained by means of chemical formulas and flow diagrams. Photographs and cross-sections of equipment are included. Hungerford & Terry, Inc.

343—Ion Exchange Material

Strongly basic anion exchanger is presented in 16-page bulletin 57. Includes complete data on physical characteristics, exchange capacity and regeneration technique. Tables and graphs along with discussions explain performance under various conditions. National Aluminate Corp.

344—Water Treatment

Laboratory pictures in this four-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

345—Water Conditioning

Conditioning for boiler, process, and general applications is discussed in 20-page booklet 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, Zeolite-alkalinity neutrization, split-stream, and anion exchange dealkalization systems are explained. Elgin-Refinite Div. of Elgin Softener Corp.

346—Water Treatment

"Industrial Water Treatment and Engineering Service," tells of the five basic lines of defense to guard against difficulties in water and steam cycles. A two-page diagram shows a water and steam cycle power plant layout and indicates the usual test required on samples taken at given points. Dearborn Chemical Co.

348—Ion Exchanger

"Demineralization Including Silica Removal by Ion Exchange," 28-page booklet 3803, describes applications, principles of operation, design features, and advantages, and gives recommendations and specifications for demineralizing and silica removal apparatus and synthetic resins. The Permutit Co.

349—Water Softener

ZEO-FLO Sodium Zeolite Softener, a water softener specially designed for small and medium size industrial plants, laundries, and hospitals, is described in four-page folder 4505-A. How the softener has been simplified so that installation may be handled readily by the facilities of a small or medium sized plant is explained along with minimum requirements, ease of operation, and low chemical costs. Cochrane Corp.

MISCELLANEOUS

350—Photocopying

"The APECO Systematic Auto-Stat Story," shows you in words and pictures what the unit is, what you can copy with it, and how much time and money you can save in your office with the Auto-Stat. According to the ten-page booklet, the machine will actually enable you to have one unskilled clerk do the copying work of six expert typists. American Photocopy Equipment Co.

RESEAT VALVES AND BIBBS
IN PLACE
QUICKLY
ACCURATELY
RESEATING A BIBB
RESEATING A VALVE
PAYS FOR ITSELF ON FIRST 2 OR 3 JOBS!
Don't junk expensive globe or angle valves, bibbs, fixtures—reseat them! Order Skinner Valve and Bibb Reseater. Easy to use. Guaranteed cutters leave seat glass-smooth, level, tight.
1/4" to 2" $47.75
2 1/4" to 3" $62.50
M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U. S. A.

Circle 574 on Reply Card for more data

DIAMOND
BI-COLOR
WATER
GAUGE
with
"HI-LITE"
Illuminator
Steam shows RED
An empty glass is entirely RED
shows GREEN
A full glass is entirely GREEN
YOU'RE ALWAYS SURE
WITH Bi-Color
There is no guessing about boiler water level when you use the Diamond Bi-Color Water Gauge. It makes use of an unvarying optical principle (the difference in refraction between water and steam) to always show water green . . . steam red. With proper illumination, the water level is unmistakable . . . whether viewed directly . . . through a system of mirrors . . . or on control panel by the use of Diamond "Utiliscope" (Wired Television).
A big improvement over other light sources, the "Hi-Lite" Illuminator uses standard high-intensity lamps similar to automobile "sealed beam" headlights. The gauge will thus retain visibility with much longer time between gauge cleanings. Use the coupon below for further information.
6706
SEND TODAY
DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Please send me without obligation a copy of new Bulletin No. 1051 explaining the advantages of Diamond Water Gauges and Water Columns.
NAME
COMPANY
ADDRESS
DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited—Windsor, Ont.

Circle 575 on Reply Card for more data

CLASSIFIED ADVERTISING

PROFESSIONAL SERVICES

PROPANE GAS PLANTS

and

Anhydrous Ammonia Plants

We Are Specialists

More than 80 Peacock Plants prove . . .
"There's No Substitute For Experience"

Address Inquiries to
PAUL E. PEACOCK, Jr., President

PEACOCK CORPORATION
Box 268, Westfield, N. J. Westfield 2-6258

---

stand by or year 'round

LP-GAS PLANTS

designed • installed

H. Emerson Thomas & Associates, Inc.
P. O. BOX 270 WESTFIELD N. J.

FOR SALE

If you pay more than 17¢ per lb.* for Wiping Cloths . . .

IT'S TIME FOR A CHANGE!!

Want the best wiping cloth money can buy for any repair shop or motor pool? At a price per pound or per yard that is low for anything comparable?

Then change to **GREASE CHAMP.** Enjoy more wiping . . . better wiping . . . for less dollars. Seventeen Cents Per Pound is the price of this uniform, cotton, mesh type wiping cloth.

Supply yourself with **GREASE CHAMP** today to effectively clean machine parts, work surfaces, work areas, and hands. Every pound has extra pickup . . . extra absorbency . . . extra nits, large, easy-to-use pieces.

Order a trial 200 lbs. now. It is your best maintenance buy. Your Satisfaction Is Guaranteed.

SAFEGUARD COMPANY, INC.
Box 113, Tamiami Station Miami 44, Fla.
*F.O.B. Holyoke, Mass.

POSITION WANTED

Mechanical Engineer, 49, married, Scotch-Irish; experienced in Steam and Power Field; B.S.M.E. (Industrial Engineering) University of Michigan '28; Registered Prof. Engr. States of Ohio, Louisiana, Alabama; Member, ASME, Instr. Soc. of Amer., Birmingham Engineering Society, Louisiana Engineering Society; twenty-five years experience field contact as Sales Engineer; Desires change to Management, Application Engineer, Liaison with Engineering and field men, Purchasing. Available May 1st.
Box No. D1
INDUSTRY & POWER, St. Joseph, Mich.

FOR SALE

FOR SALE

1—8750 KVA Power Plant, coal fired, 2 unit, 1—5000 KVA turbo alternator, 1—3750 KVA turbo alternator, 2300 volt, modern, complete transformers 2300/7200/12470 output, can be separated and operated as two units. Can be purchased at mere fraction of original cost.

Guyan Machinery Co. Logan, W. Va.

GAGE GLASSES AND
High Pressure Rubber Gaskets
ALL SIZES TO FIT YOUR WATER GAGES

ERNST WATER COLUMN & GAGE CO.
Send for Catalog LIVINGSTON, N. J.

AVAILABLE REPRINTS

SPECIAL REPORT REPRINTS

"Industrial Development Review"
"Control Valves and Positioners"
"Adjustable Speed Drives and Electrical Controls"
"Combating Corrosion From Ind. Chemicals"
"Packaged Electrical Distribution Equipment"
"Contaminants in the Air"

Write for your free copy today—one copy of each mailed upon request, with the compliments of INDUSTRY AND POWER. Additional copies — 2 to 25 copies 25c each; 26 to 50 copies — 20c each; 51 to 100 copies — 15c each; more than 100 copies — 10c each. Your requests will receive the prompt attention of Reader Service Department, INDUSTRY AND POWER, St. Joseph, Michigan.

Free of charge — For your personal files, reprints listed below:

"More Power For Jamestown," Dec. 1953
"Coal Handling at Elrama," Dec. 1953
"New Water Tube Package Boiler," Dec. 1953
"Burners For Package Boilers," Oct. 1952
"Handbook" for 1953
"Maintenance of Exhaust Systems," Oct. 1953
"Hidden Losses From Electrical Systems," May 1953
"Insulation . . . Types and Proper Application," Nov. 1952
"Maintenance 'Know How' Means Efficient Batteries," Aug. 1951
"Fundamental Designs and Design Considerations of Industrial Condensers," Aug. 1952
"Adjustable Speed Fluid Drives," May/June 1953
"Modern Fuel Oils and the Application of Additives," Oct. 1951
"Package Boilers Reduce Steam Costs," Feb. 1953
"Application of Spreader Stokers," March 1953
"Dirty Water Gets The Treatment," Aug. 1953
"Variable Pitch Motor Pulleys for Power Transmissions," Aug. 1953
"Interpreting Stack Losses," Aug. 1953
"Axial Flow Pumps . . . Their Characteristics," July 1952
"Joining Copper and Its Alloys," Aug. 1952
"Low Cost Auxiliary Power From Turbine Drives," Apr. 1950
"Modern System Moves 600 Ton of Coal Per Hour," Feb. 1952
"Metal Chip Handling," Oct. 1953
"What Moisture Resistance Means in Cable Insulation," Apr. 1953
"Pump Materials That Can Reduce Corrosion," Nov. 1952
"Selecting Taps on Power Transformers," Apr. 1953
"Eddy Current Couplings for Speed Control and Clutching," Dec. 1952
"Profits From Wastes," Nov. 1952
"The Proper Water Tower Means Water Conservation," March/April 1951
"Meeting Gas Curtailment With Propane," April 1952
"Continuous Blowdown Systems," March 1953
"Feedwater Heating Calculations For Steam Turbines," May 1953
"Accelerating Wound Rotor Motors," May 1953
"Industrial Waste Treatment," June 1951
"Valve Positioners," Apr/May 1952
"Savings By The Tank Car," Dec. 1953

spot news

— Starts on page 86

furnace is a departure from the conventional "Dutch Oven" and "pile" burning of refuse fuels.

The reset boiler is now delivering 30 percent more steam and burning fuel more efficiently than the adjacent 150 hp boiler with "Dutch Oven."

Previous to the new installation, the third boiler, a gas-fired unit, was in service daily. Gas is now used only over week-ends.

Crane and Fork-Truck Handle Dies

With the first floor area needed for manufacturing operations and for the storage of frequently used dies, inactive die storage has been relegated to the basement at the Ivanhoe Plant of the Perfection Stove Co. Even though the use of these dies is somewhat infrequent, when needed they provide a serious handling problem since they are far too heavy for safe manuel handling.

Because ramps or elevators to the basement are not available, the 8000 lb capacity Elwell-Parker electric fork truck used to handle the dies is raised and lowered by means of an overhead traveling bridge crane. On the first floor, the dies brought up are transferred to the crane which in turn delivers them to the presses.

The system has meant the freeing of needed production area, the safe, effective storage of dies, and handling methods that have diminished physical exertion and possible accidents to personnel.

meetings

. . . and exhibitions

April 15-19	American Institute of Electrical Engineers (Southern Textile Conference)	Georgia Tech. Atlanta, Ga.
April 21-23	American Institute of Electrical Engineers (Feedback Control Conf.)	Hotel Claridge Atlantic City, N. J.
April 26-30	American Society of Tool Engineers (Industrial Exposition)	Convention Center Philadelphia, Pa.
May 4-7	American Welding Society (Spring Meeting)	Statler Hotel Buffalo, N. Y.
May 10-12	Compressed Air and Gas Institute (Spring Meeting)	The Homestead Hot Springs, Va.
May 16-19	American Institute of Chemical Engineers (Summer Meeting)	Springfield, Mass.
May 17-20	Basic Materials Conference (2nd Annual Exposition)	Amphitheater Chicago, Ill.

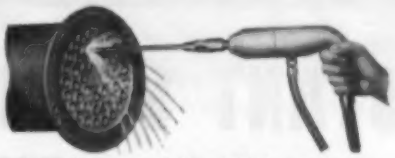
It's a cinch to clean any size heat exchanger tube the Wilson way!

Why put up with the delays and the high costs of makeshift tube cleaning methods? Wilson has exactly the tube cleaner you need to do the job quickly, thoroughly, economically. Wilson's complete line of fast-acting tube cleaners includes the popular PG for ⅜" to 1", the PGX for intermediate sizes ½" to 1½", and the TP-301 for up to 2⅞" ID.

For Small Sizes
MODEL PG
PISTOL GRIP
TUBE
CLEANER

The fast, efficient Pistol Grip Tube Cleaner provides the operator with one-hand control for cleaning small, straight tubes. Weighs only 3 lbs—no more than a 12" Stillson wrench.

For Intermediate Sizes
MODEL PGX TUBE CLEANER



Positive drive (not geared down) high speed, rotary shaft, air-driven scavenger type cleaner. Washes out tube and debris as it cleans, keeping drill bit cool at the same time. For either vertical or horizontal applications, straight or curved tubes.

For
Heavy-Duty
Service
MODEL TP-301
TUBE
CLEANER

Suitable for vertical or horizontal use in straight or curved tubes ⅜" ID to 2⅞" ID and up to 40' long. Cleans rapidly, thoroughly, operating at high speed at 90 psi. Can run on pressure as low at 50 psi.

Representatives in all principal cities

WRITE FOR BULLETIN TW-829

Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City 1, N. Y.
CABLE ADDRESS: "TUBECLEAN" NEW YORK

TW 830

WILSON
TUBE CLEANERS • TUBE EXPANDERS

Circle 576 on Reply Card for more data

Protect COMPRESSED AIR TOOLS

With Armstrong Air Traps!

MOISTURE in air lines washes out the lubricant in compressed air tools, causes excessive wear and corrosion. For maximum protection against moisture damage install one of three types of Armstrong Air Traps on aftercoolers, separators, receivers and at low points on air lines.

No. 71 Snap Action Trap

1. The Armstrong No. 71 Snap Action Air Trap is the ideal answer on many systems. The valve opens and closes with a snap—no dribbling, no hunting, not held open by small dirt particles. Can't leak costly air and no priming is necessary. Cast body for pressures to 250 psi, forged steel to 1000 psi.

No. 21 Ball Float

2. The No. 21 Ball Float Trap is the low cost, high quality trap for service where very little dirt or scale is encountered. For pressures to 125 psi.

No. 213 Inverted

3. The Inverted Bucket Type Trap (in several sizes) is the only air trap manufactured suitable for severe dirt and oil conditions; is frequently recommended for inter-cooler drainage on two stage compressors where considerable oil is encountered.

All Armstrong Air Traps are unconditionally guaranteed to give satisfaction. WRITE FOR BULLETIN 2021. ARMSTRONG MACHINE WORKS, 820 Maple St., Three Rivers, Mich.

ARMSTRONG Air TRAPS

Circle 577 on Reply Card for more data

INSTANT SETTING CONCRETE FLOOR PATCH

TEST IT ON TRIAL OFFER

STAYS PUT! FAST!

Repair broken factory floors without the usual traffic tie-up. Simply shovel INSTANT-USE into hole or rut — tamp smooth — truck over! No waiting! INSTANT-USE bonds tight to old concrete — right up to a feather edge. It's tough. Wears like iron. Won't crack or crumble. Install complete overlay where floors are badly chewed up. Used indoors or out. Immediate shipment.

MAIL COUPON for TRIAL OFFER and FREE HANDBOOK

INSTANT-USE

FLEXROCK COMPANY (Offices in principal cities)
3605 Filbert St., Philadelphia 1, Pa.

Please send me complete INSTANT-USE information details of TRIAL ORDER PLAN and HAND BOOK OF BUILDING MAINTENANCE — no obligation. (Clip and attach Coupon to Co. letterhead).

Name .....
Title .....
Company .....
Address .....

Circle 578 on Reply Card for more data

advertiser's index

Acme Electric Corp. ..... *
Aerotec Corp., The 49
Airetool Manufacturing Co. ..... *
American Metal Hose Branch, The American Brass Co. 91
American Photocopy Equipment Co. 97
Ames Iron Works ..... *
Armstrong Machine Works 114
Arrow-Hart & Hegeman Electric Co., The 37
Atlantic Metal Hose Co. ..... *
Atlas Valve Co. ..... *
Aurora Pump Co. 101

Babcock & Wilcox Co., The ..... *
Bell & Zoller Coal Co. 46
Betz, W. H. & L. D. 9
Bituminous Coal Institute 43
Buell Engineering Co. 108
Burgess-Manning Co. 97
Bussmann Mfg. Co. ..... *

Chapman Valve Mfg. Co., The 89
Chesapeake and Ohio Railway 22
Chicago Pneumatic Tool Co. ..... *
Cleaver-Brooks Co. ..... *
Cochrane Corp. 4
Combustion Engineering, Inc. ..... *
Coppus Engineering Co. 33
Cyclotherm Div., U. S. Radiator Corp. ..... *

Darling Valve & Mfg. Co. ..... *
Dart Union Co. 96
Dearborn Chemical Co. 14-15
DeLaval Steam Turbine Co. 25
Detroit Stoker Co. ..... *
Diamond Power Specialty Corp. 111

Economy Fuse and Mfg. Co. ..... *
Edward Valves, Inc. 91
Electric Auto-Lite Co., The 107
Elgin-Refinite Inc., Div. of Elgin Softener Corp. ..... *
Engineer Co., The 14
Everlasting Valve Co. 103

Farmers Engineering and Mfg. Co. ..... *
Felt Products Mfg. Co. ..... *
Flexrock Co. 114
Foster Co., The ..... *

Gates Rubber Co., The 42
General Coal Co. 100
General Electric Co. 26-27
Goodyear Tire & Rubber Co., Inc. 3
Grinnell Co., Inc. 17

Hapman-Dutton Co., Dutton Boiler Div. ..... *
Hartzell Propeller Fan Co. ..... Second Cover
Hays Corp., The 34
Heacon, Inc. ..... *
Heinemann Electric Co. ..... *
Henszey Co. ..... *
Hilliard Corp., The 88
Hoffman Specialty Mfg. Corp. .. 40
Hungerford & Terry, Inc. 110

Ideal Industries, Inc. 105
International Nickel Co., Inc., The 32
I-T-E Circuit Breaker Co. 18-19

Jeffrey Mfg. Co., The 13
Jerguson Gage & Valve Co. 109
Johnson Corp., The ..... *
Johns-Manville Corp. ..... *

Kirk & Blum Mfg. Co. ..... *

Leslie Co. 7
Lewellen Mfg. Co. 6
Link-Belt Co. 29
Liquidometer Corp., The 110
Lovejoy Flexible Coupling Co. 104

Manhattan Rubber Div., Raybestos-Manhattan, Inc. 47
Manzel Div. of Frontier Industries, Inc. 109
Murray Iron Works Co. ..... *
Murray Mfg. Co., D. J. ..... *

National Airoil Burner Co., Inc. 38
National Aluminate Corp. ..... *
New York & New Jersey Lubricant Co. 105
Niagara Blower Co. ..... *
Nicholson & Co., W. H. 87
Northern Blower Co., The ..... *

Orchem Pump Div. 99

Packing Div., Raybestos-Manhattan, Inc. ..... *
Peabody Engineering Corp. 24
Petro 95
Pick Manufacturing Co. ..... *
Powers Regulator Co., The 23
Prat-Daniel Corp. 82
Preferred Utilities Mfg. Corp. .. 28
Proto Tools ..... *

Raybestos-Manhattan, Inc., Manhattan Rubber Div. 47
Refractory & Insulation Corp. ... 94
Rockwell Co., W. S. 106
Rohm & Haas Co., Resinous Products Div., The .. *

Sarco Co., Inc. 101
Shaw Co., Benjamin F. Fourth Cover
Shell Oil Co. 21
Sims Pump Valve Co., Inc. 97
Sinclair Refining Co. ..... *
Skinner Co., M. B. 111
Smooth-On Mfg. Co. 92
Sorensen & Co. ..... *
Spence Engineering Co., Inc. ... 48
Standard Oil Co. (Indiana) ... 45
Standard Pressed Steel Co. 101
Sun Oil Co. 77
Superior Combustion Industries, Inc. 98
Sweet's Catalog Service 107

Terry Steam Turbine Co., The .. 78
Texas Co., The ..... *
Thermix Corp., The 82

U. S. Electrical Motors, Inc. 101
Universal Atlas Cement Co. 44

Vogt Machine Co., Henry 41

Wagner Electric Corp. ..... *
Weinman Pump Mfg. Co., The .. 90
Western Precipitation Corp. ..... *
Wickes Boiler Co., The. Third Cover
Wiedeke Co., The Gustav ..... *
Wiegand Co., Edwin L. 31
Wilson Inc., Thomas C. 113
Wing Mfg. Co., L. J. ..... *
Worthington Corp., Centrifugal Pump Div. ..... *
Compressor Div. ..... *
Steam Turbine Div. 11
Vertical Turbine Pump Div. 10
Wright-Austin Co. ..... *

Yarnall-Waring Co. 38-39, 50

Where an * appears after a name the advertisement does not appear in this issue, but appeared in one or both of the two previous issues.

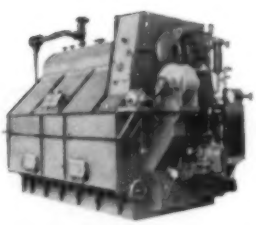
100th ANNIVERSARY WICKES BOILERS 1854-1954

Early photograph of Wickes' shop force

The year was 1854. Franklin Pierce was President. Stephen A. Douglas was leading a fight to abolish the Missouri Compromise on slavery. The railroads were beginning their first westward expansion . . . just the year before, rail connection had been established between New York and Chicago. Only 10 years before, Samuel F. B. Morse had invented the telegraph, and new inventions were rapidly changing the face of American industry. Large scale production was at hand, and industry stood on the threshold of a new, remarkable era.

Though the first Wickes Boilers would look crude indeed alongside the highly efficient units Wickes makes today, they were quite advanced for their time, and industry soon learned that the name Wickes stood for dependable low-cost steam production. Through constant research, expansion of manufacturing facilities and the introduction of modern production techniques, Wickes has maintained that position of leadership for the last 100 years.

Today, Wickes can supply your requirements for steam generators capable of producing 500,000 lbs. steam per hour at pressures up to 1000 psi. — all types of multiple drum boilers adaptable to any standard method of firing. For pressures up to 900 psi., with sustained steam production up to 40,000 lbs., Wickes Type A Boilers can be shop-assembled, ready for immediate installation. Consult your nearest Wickes representative or write today for descriptive literature.



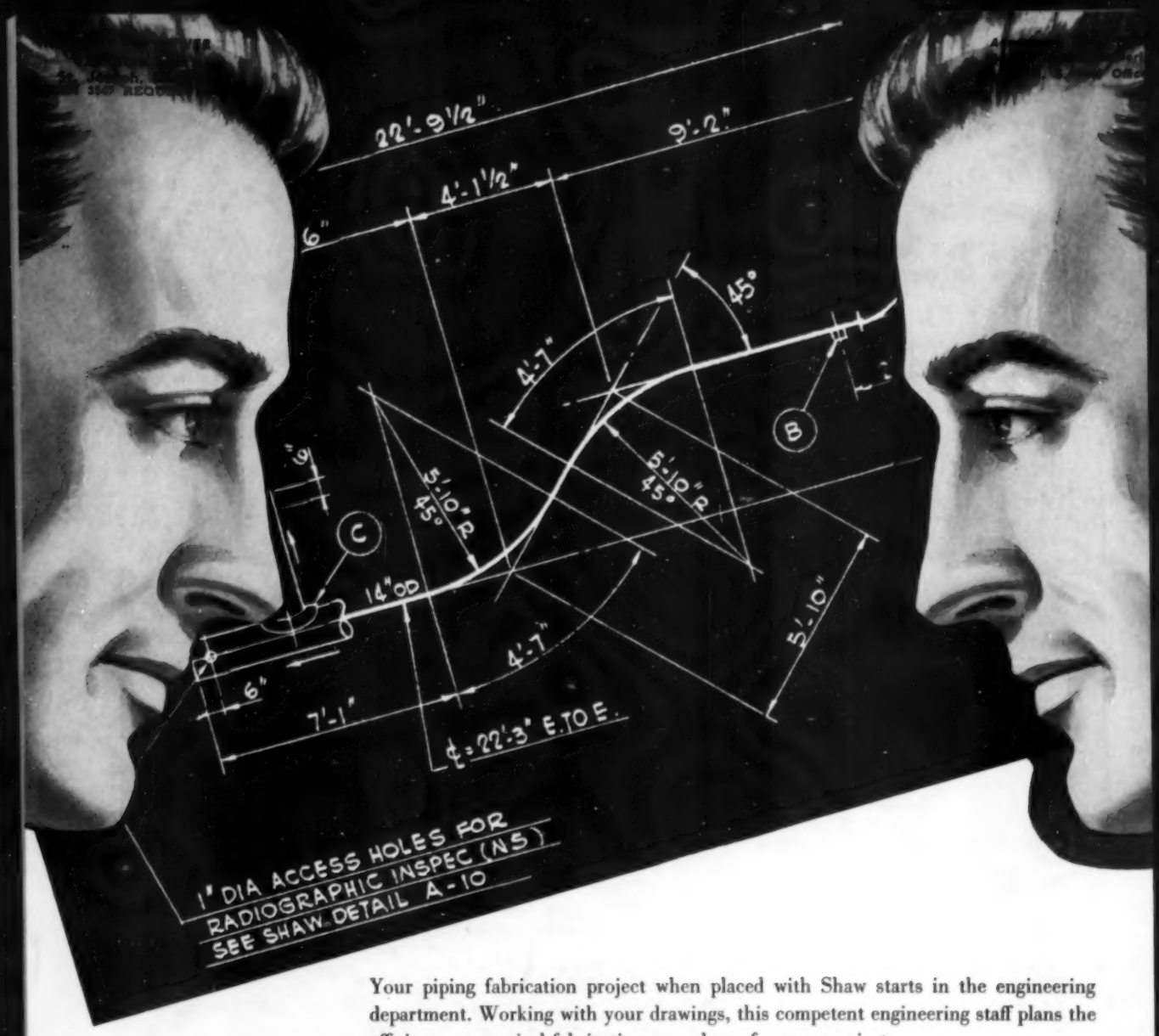
THE WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

SALES OFFICES: Albuquerque, N.M. • Boston • Buffalo • Charlotte, N.C. • Chicago • Cleveland • Dallas • Denver • Detroit • Fort Wayne, Ind. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D.C.

RECOGNIZED QUALITY SINCE 1854

Circle 579 on Reply Card for more data



LET'S FACE IT...

Your piping fabrication project when placed with Shaw starts in the engineering department. Working with your drawings, this competent engineering staff plans the efficient, economical fabricating procedures for your project.

These fabricating plans, containing complete details for the efficient production-line handling of your entire project, are reproduced in multiple copies for use by all departments concerned with your job. This assures you the efficient integration of your entire project into the over-all work schedule of the Shaw plant. This assures you savings in both time and money.

Backing this accurate production schedule and expediting the completion of your project is Shaw's inventory of fully-tested raw materials in sizes and specifications adequate for most piping requirements.

There's no reason to buy where lack of skilled planning and inadequate inventory of raw materials cause time and money losses. Whether you are buying one piece of piping or a complete plant installation, Shaw's experienced personnel, accurate planning and large inventory of piping are your assurance of a job well done from inception to completion, at lower cost to you. Buy from Shaw—it pays—all ways.

SHAW

Circle 580 on Reply Card for more data